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2013 Annual Groundwater Monitoring Report
Palermo Wellfield Superfund Site,
Tumwater, Washington

for

Washington State Department of Transportation

February 17, 2017

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Earth Science + Technology

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1.0 INTRODUCTION

This annual report was prepared to summarize Spring and Fall 2013 semiannual groundwater monitoring results at the Palermo Wellfield Superfund Site (Site), U.S. Environmental Protection Agency (EPA) ID: WA 0000026534, located in Tumwater, Washington (Figure 1). This annual groundwater monitoring report was prepared for the Washington State Department of Transportation (WSDOT) in accordance with the requirements described in the Administrative Settlement Agreement and Order on Consent for Response Actions (ASAOC) Statement of Work (SOW), CERCLA Docket 10-2012-0149, entered into by EPA and WSDOT, effective July 6, 2012 (EPA 2012a). Before 2013, semiannual groundwater monitoring was conducted by the EPA as part of the remedy selected for the Site as documented in the Record of Decision (ROD) dated November 16, 1999 (EPA, 1999). The EPA began monitoring groundwater semiannually for tetrachloroethene (PCE) and trichloroethene (TCE) as part of the long-term monitoring program.

In the spring of 1999, EPA began operating an air stripping treatment system at the Palermo Wellfield to remove TCE from groundwater. Operation and maintenance of the groundwater treatment system is the responsibility of the City of Tumwater (City) based on an agreement with EPA.

TCE and PCE also were detected in surface water samples from the base of the Palermo bluff where it ponded in the yards and crawl spaces of nearby homes. A subdrain system and treatment lagoon were constructed in 2000. The purpose of the system is to lower the local groundwater table beneath homes west of SE Rainier Avenue and remove the TCE and PCE from the collected water (Figure 2). Following the construction and verification of subdrain and treatment lagoon performance period, a maintenance program was established and implemented by the Washington State Department of Ecology (Ecology). Ecology monitored the subdrain and lagoon system performance between 2002 and 2008. In November 2009, EPA assumed the lead for the performance monitoring of the subdrain and treatment lagoon system. The subdrain system includes a subgrade perforated piping network installed behind the seven southern-most houses west of SE Rainier Avenue. The main perforated pipe or “trunk drain” is beneath the backyards of the houses. Groundwater accumulated in the perforated pipe flows to an unperforated “tightline” pipe beneath SE Rainier Avenue and SE M Street. The tightline pipe drains to a treatment lagoon located at the City of Tumwater Municipal Golf Course. PCE and TCE are removed from the water by surface aeration before it is discharged to the Deschutes River by way of an existing water course.

From 2004 to present, annual reports have been prepared for groundwater monitoring and subdrain and treatment lagoon monitoring programs. This document represents the first annual groundwater monitoring report in accordance with the SOW outlined in the ASAOC between the EPA and Washington State Department of Transportation (WSDOT) dated July 2012.

2.0 SCOPE OF WORK

Under Section C4 of the ASAOC Statement of Work (SOW), this annual report summarizes and analyzes data collected from groundwater sampling events conducted during 2013, presents trend data, describes unusual conditions, provides recommendations, and a discussion of the capture zone. This annual report also includes a summary of operations and maintenance activities pertaining to the subdrain and treatment lagoon system. These activities were generally completed using procedures presented in the following documents for the Spring and Fall 2013 monitoring events:

- *Field Sampling and Analysis Plan – Semiannual Groundwater Monitoring, Palermo Wellfield Superfund Site (FSP)* (GeoEngineers, 2013a).
- *Operation and Maintenance Manual Subdrain System* and *Treatment Lagoon Palermo Wellfield Superfund Site (O&M Manual) (URSG, 2002).*
- *Amendment Operation and Maintenance Manual Subdrain System and Treatment Lagoon, Palermo Wellfield Superfund Site* (GeoEngineers, 2013b).

Activities completed under these documents for the Spring and Fall 2013 monitoring events include:

- Collection of groundwater water samples from 53 groundwater monitoring locations.
- Collection of water samples from nine subdrain and treatment lagoon locations.
- Measurement of sediment accumulation and discharge rate at 12 subdrain and treatment lagoon locations.

This annual report provides a summary of the groundwater data obtained from the Spring and Fall 2013 sampling events in accordance with ASAOC SOW.

3.0 GROUNDWATER

This section presents information on semiannual field activities, analytical results, concentration trends, and discusses the groundwater capture zone of the Palermo Wellfield.

3.1. Semiannual Field Activities

Field activities conducted during the Spring and Fall 2013 monitoring events included collection of 53 samples from the following locations:

- Thirty (30) monitoring wells
- Fifteen (15) shallow groundwater piezometers
- Four (4) seeps
- Four (4) wellfield locations

Attributes of monitoring locations and groundwater level elevations observed during the Spring and Fall 2013 sampling events are presented in Tables 1 and 2 and Figures 3 and 4. Field forms associated with the sampling are provided in Appendix A. Specific details about the monitoring locations are described below. Deviations from the FSP are outlined in the Section 3.1.5.

3.1.1. *Monitoring Wells*

Groundwater from 30 monitoring wells was sampled as identified in the FSP (GeoEngineers, 2013a). Samples were generally collected using a portable Grundfos submersible pump at monitoring wells with the exception of monitoring wells MW-93-02 and MW-96-17 which were sampled using a peristaltic pump and an internal hand pump, respectively. Field parameter measurements were recorded using a multi-parameter water quality meter and a turbidimeter.

3.1.2. *Shallow Groundwater Piezometers*

Groundwater from 15 piezometers in the Palermo neighborhood and near the base of the bluff was sampled in accordance with the FSP with the exception of piezometer PZ-709. Piezometer groundwater samples were collected using a peristaltic pump after field parameter stabilization.

3.1.3. *Seeps*

Four groundwater seep samples were collected from locations near the base of the bluff and from a drainage ditch located west of the Palermo Wellfield (Figure 2). These samples were collected using a peristaltic pump after collecting three sets of field parameters.

3.1.4. *Wellfield Locations*

Three production wells and one air stripper tower were sampled at the Palermo Wellfield during the Spring 2013 monitoring event. Two production wells and one air stripper were sampled during the Fall 2013 event. Consistent with the FSP, no field parameters were collected for these locations.

3.1.5. *Deviations from the Groundwater Monitoring FSP*

The list outlined below is specific to deviations from the FSP which occurred during 2013.

- During the Spring 2013 monitoring event, the sample for Seep 5 was collected directly from the surface water drainage channel without a screen because the screen would not allow water to penetrate through.
- For both monitoring events, MW-96-17 and MW-93-02 were not sampled with a submersible pump. Monitoring well MW-96-17 was sampled by a permanent internal down-hole pump maintained by the City of Tumwater. A peristaltic pump was used to collect the sample from MW-93-02 because an obstruction (stick) was present in the well casing. The stick was partially removed from the casing by the City of Tumwater during the Fall 2013 monitoring event, but could not be completely extracted.
- The City of Tumwater wells MW-96-15 and MW-96-16 contain a different brand of submersible pump (QED Micropurge pump) which is not compatible with the Grundfos submersible pump system. These pumps were removed before sample collection and then replaced after sampling was completed for both the Spring and Fall monitoring events.
- Piezometer PZ-709 did not yield sufficient water to purge until field parameters stabilized. The piezometer was allowed to recharge for approximately an hour. After recharging, the piezometer provided enough water for sample collection without field parameter stabilization. The sample collected from PZ-709 during the Spring 2013 monitoring was dark in color, exhibited a rainbow sheen, and was observed to have a noticeable petroleum-like odor. This sample was analyzed for the full suite of volatile organic compounds (VOCs) rather than the project list of VOCs outlined in the FSP to provide information on characteristic VOCs indicative of petroleum releases. Similar recharge conditions were observed during Fall 2013.
- One of the air stripper towers was sampled during both monitoring events because the second tower was offline.

3.2. Groundwater Monitoring Analytical Results

This section describes the results of the laboratory analysis completed for the Spring and Fall 2013 sampling events including a data quality assessment, comparison to ROD cleanup goals, and a brief description of the results from each of the four sample location types. Tabulated analytical data are included in Appendix B. Data validation reports are presented in Appendix C. Laboratory analytical reports are presented in Appendix D. Table 3 and Figures 5 through 8 summarize PCE and TCE concentrations at the groundwater monitoring locations.

3.2.1. *Data Quality Assessment*

Data quality for both the Spring and Fall 2013 semiannual groundwater sampling was found to be acceptable. A detailed assessment is provided in the data validation reports in Appendix C.

3.2.2. *Groundwater Record of Decision Cleanup Goals*

Site groundwater chemicals of concern identified in the 1999 ROD are PCE and TCE (EPA, 1999). Analytical results discussed below were evaluated against the ROD remediation goals (RGs) for these chemicals. ROD RGs for PCE and TCE are 5 micrograms per liter (µg/L), the maximum contaminant level (MCL) for drinking water as referenced in the Federal Clean Water Act.

3.2.3. *Monitoring Wells*

PCE and TCE were the primary VOCs detected in groundwater which is consistent with historical sampling results. The maximum concentration of PCE detected in groundwater was located at MW-ES-04 for both 2013 events at 44 µg/L during the Spring and 32 µg/L during the Fall sampling events. The maximum concentration of TCE detected in groundwater was 120 µg/L at MW-ES-09 for both 2013 sampling events. Both PCE and TCE detected in groundwater exceeded the 5 µg/L RG at some locations as shown on Figures 5 through 8.

Additional compounds detected in samples from monitoring wells included cis-1,2-dichloroethene (cis-1,2-DCE) at a concentration of 0.34 µg/L at MW-UI and naphthalene at a concentration of 1.8 µg/L at both MW-ES-03 and MW-ES-04 in the spring monitoring event. No additional compounds were detected during the fall sampling.

3.2.4. *Shallow Groundwater Piezometers*

The Spring and Fall 2013 piezometer results represent the first and second collection of shallow groundwater piezometer analytical data under the existing FSP. PCE and TCE analytical results for these piezometers are presented in Figures 5 through 8.

PCE was detected at a concentration of 0.38 µg/L in piezometer PZ-720 for the spring monitoring event. Similar conditions were observed for the Fall 2013 sampling where PCE was detected at the same location at a concentration of 0.55 µg/L.

TCE was detected at about half of the piezometers at concentrations ranging from 0.6 µg/L to 32 µg/L. TCE was detected in groundwater samples from three of these piezometers (PZ-720, PZ-721, and PZ-724) at or above the 5 µg/L RG in the spring event. TCE was detected at the same piezometers during the fall event at concentrations ranging from 1.6 µg/L to 54 µg/L. TCE was also detected at piezometer PZ-728 during the fall event in the same concentration range at 5.1 µg/L.

Four additional compounds were detected in four piezometers during Spring 2013. Groundwater samples from PZ-724 and PZ-728 contained concentrations of cis-1,2-DCE at 1.2 µg/L and 0.31 µg/L, respectively. PZ-728 also contained concentrations of ethylbenzene (0.39 µg/L) and toluene (0.84 µg/L). Two locations along the bluff contained concentrations of 1,3-dichlorobenzene of 0.38 µg/L at PZ-709 and 0.65 µg/L at PZ-715.

Acetone was detected at piezometer PZ-709 at an estimated concentration of 19 µg/L for the Fall 2013 sampling event. The groundwater from this sampling location was observed to have a petroleum-like odor and rainbow sheen.

3.2.5. *Seeps*

PCE and TCE were not detected in samples collected at the four seep locations during both 2013 sampling events (Figures 5 through 8). The groundwater sample from Seep 3 contained 15 µg/L toluene during the Spring 2013 sampling event.

No additional compounds were detected for the Fall 2013 sampling event.

3.2.6. *Wellfield*

TCE was detected at one of the three water supply wells sampled during the Spring and Fall 2013 sampling events. Both spring and fall concentrations for production well TW-4 (1.7 and 1.3 µg/L, respectively) were below the ROD remediation goal of 5 µg/L before treatment through the air stripper treatment. PCE and TCE were not detected in the effluent sample collected from Stripper Tower ST-2. No additional compounds were detected at the wellfield locations.

3.3. Mann-Kendall Trend Test

The Mann-Kendall trend test was used to evaluate changes in PCE and TCE concentrations at monitoring well locations on the Site over time. Overall results from the trend test are presented in Table 4. The Mann-Kendall trend test was performed using data collected since 2004 when long-term monitoring began at the Site. The tests were performed using the EPA software package ProUCL, using a 95 percent confidence limit. Concentrations of PCE and TCE did not demonstrate a statistically significant increasing trend at any of the monitoring locations using the Mann-Kendall trend test. The trend test does indicate a statistically significant decreasing trend in concentrations of PCE or TCE at 11 monitoring wells and production well TW-5. PCE and TCE concentration trends were demonstrated using analytical data from the piezometers. Basic trend plots have been provided for comparison in Appendix E.

3.4. Capture Zone

A preliminary capture zone analysis was performed and included in the *Draft Summary of Existing Information Report* (GeoEngineers, 2013d). The capture zone analysis is included in Appendix F.

The City of Tumwater has shared that the Palermo Wellfield has recently been operating intermittently and at lower capacity because of the following circumstances:

- Three production wells are active at the wellfield. One production well has been abandoned since development of the wellfield and one production well has recently been installed in 2012, but is not yet active.

- The City's water supply needs are being met by other water sources. We understand the Palermo Wellfield's lower yield is temporary until new production wells are installed and connected to the treatment system.

The Statement of Work (EPA, 2012) requires that a capture zone analysis be included in the annual groundwater monitoring report. The capture zone analysis will be revised when operations have resumed at the wellfield, and data are available to include in a revised analysis.

3.5. Conclusions

Conclusions are provided in the following subsections:

3.5.1. *Monitoring Wells*

Discussion of conclusions surrounding the monitoring wells focuses on results and general trends.

3.5.1.1. RESULTS

PCE and TCE in groundwater samples from monitoring wells appears to be similar in concentration between Spring and Fall 2013 (Figures 5 through 8). Groundwater samples collected from monitoring wells MW-ES-04 and MW-ES-06 exceeded the PCE 5 µg/L ROD RG for both sampling events and appear to be limited to the area between the present O'Reilly Auto Parts and Brewery City Pizza. Detectable concentrations of TCE appear to be less localized. TCE exceeding the ROD RG of 5 µg/L extends from MW-UI on the southwest corner of the intersection of Trosper Road and Littlerock Road to the well pair MW-ES-09 and MW-ES-10 at the intersection of SE Rainier Avenue and SE O Street in the Palermo neighborhood.

3.5.1.2. TRENDS

Groundwater from many of the monitoring wells has been monitored for years such that concentrations can be evaluated over time. The Mann-Kendall trend test performed on the monitoring well groundwater analytical data show that concentrations of PCE and TCE are either stable or decreasing at each location where chemicals of concern have been detected and sufficient data have been collected to perform the Mann-Kendall trend test. The results of the Mann-Kendall test indicate concentrations of PCE and TCE have not increased during long term monitoring at the Site. Groundwater samples from approximately one quarter of the wells with sufficient PCE data are statistically decreasing in concentration. Over half of the wells with sufficient TCE data also show a statistically decreasing trend in concentration. Of the monitoring wells where decreasing concentrations of PCE and TCE were not statistically supported, concentrations were either stable, or insufficient data have been obtained to establish a statistically significant trend. This information is useful to evaluate which locations are important to the monitoring network and where more information may be needed.

3.5.2. *Shallow Groundwater Piezometers*

Similar to the monitoring wells, conclusions for the piezometers focus on results and also discuss extent.

3.5.2.1. RESULTS

PCE and TCE concentrations at the piezometers were similar between the Spring and Fall 2013 monitoring events. With the exception of the groundwater samples collected from piezometer PZ-721, PCE was not detected in groundwater samples from the piezometers at concentrations exceeding laboratory reporting limits. Concentrations of PCE were detected below ROD RGs from PZ-720 during both events. This location is generally near the intersection of SE Rainier Avenue and SE N Street where PCE is has been detected in the subdrain.

TCE exceeding the ROD RGs in shallow groundwater from the neighborhood piezometers was detected in three locations during the spring and four locations during the fall. These locations are also near the intersection of SE Rainier Avenue and SE N Street but extended to SE Palermo Avenue during the fall sampling. Lower than ROD RG concentrations of TCE were detected in shallow groundwater that appears to follow a semi-circular pattern from piezometer PZ-719 to PZ-726 at the intersection of SE Palermo Avenue and SE M Street to RPZ-731 at the east end of SE N Street and ending at PZ-728 in SE Palermo Avenue. This pattern is important because it appears to define a limit or extent of the shallow groundwater TCE contamination. See Figures 6 and 8.

3.5.3. *Seeps*

Seep samples collected during the 2013 semiannual monitoring period did not detect PCE or TCE. These results are consistent with samples collected from the same locations in 2012.

3.5.4. *Wellfield*

TCE and PCE were not detected in water samples collected from the stripper towers during monitoring performed in 2013. During both semiannual sampling periods the Palermo Wellfield was not operating, which provided an opportunity to observe water levels and collect groundwater samples in the neighborhood under non-operational conditions. These conditions yielded similar analytical results between spring and fall monitoring events. Conclusions from the wellfield are mainly related to operations and capture zone.

3.5.4.1. OPERATIONS

Based on our current understanding of wellfield operations, three of the original six production wells that were evaluated as part of the remedy remain active and produce water for public consumption. The City of Tumwater has decommissioned two of the production wells while a third remains inactive and awaits further assessment. To augment the lower water volumes produced at the Palermo Wellfield, the City of Tumwater installed one new production well in 2012 (TW-16) and another production well (TW-17) in 2014. Groundwater from production well TW-16 was analyzed in 2012 and contained TCE at a concentration of 19.5 µg/L, greater than the ROD RG of 5 µg/L. PCE and TCE were not detected in a sample collected from production well TW-17 collected in January 2014. We understand the City plans to provide a connection to the treatment system for both TW-16 and TW-17 in the coming few years to increase production of the wellfield.

3.5.4.2. CAPTURE ZONE

As indicated in the capture zone analysis discussion, the City of Tumwater is undergoing a wellfield redevelopment and expansion program to return pumping capacity to the Palermo Wellfield. During this redevelopment and expansion program, the wellfield has not continually operated. The wellfield and treatment system are key components to the site remedy. A capture zone analysis is important to evaluating the overall site remedy and will be updated when the wellfield is consistently operating.

4.0 SUBDRAIN AND TREATMENT LAGOON

The purpose of the subdrain and lagoon system is to lower the groundwater depth beneath the homes west of SE Rainier Avenue to at least 18 inches (1.5 feet) below the bottom of the crawlspaces or 3 feet below ground surface (URSG, 2002). This increase in groundwater depth aims at reducing the risk of vapor intrusion into the homes from shallow groundwater containing PCE and TCE. Shallow groundwater collected in the subdrain is conveyed via a tightline pipe and treated via surface aeration at a treatment lagoon before being discharged to an existing water course (Figure 2). The following sections describe the field activities, results, and conclusions for the subdrain and treatment lagoon performance monitoring.

4.1. Field Activities

4.1.1. *Subdrain and Tightline*

The subdrain located behind the houses on the western side of SE Rainier Avenue collects shallow groundwater though an underground perforated pipe and conveys the water to a series of catch basins by a solid tightline pipe. This section describes performance monitoring for this portion of the remedy and includes sampling, water elevation monitoring, discharge rate measurements, and sediment accumulation monitoring.

4.1.1.1. SAMPLING

Subdrain cleanout samples were collected using a polyethylene dipper by lowering the cup portion into each of the cleanouts, placing it under the outfalls, or by submerging it into the water. Samples were submitted to the same laboratory as the groundwater samples under the same chain of custody procedures, and for the same analyses.

4.1.1.2. WATER ELEVATION MONITORING

Depth to water measurements were collected from the neighborhood piezometers, the subdrain cleanouts and the tightline catch basins using an electronic water level indicator. The measurements were used to calculate groundwater elevations in the neighborhood (Table 5 and Figures 9 and 10).

4.1.1.3. WATER FLOW RATE MEASUREMENTS

Flow rate was measured using a Global Flow Meter as outlined in the O&M Manual and the discharge was calculated to equate to gallons per minute (gpm). Figures 11 and 12 and Tables 6A and 6B shows the discharge volumes encountered in the subdrain.

4.1.1.4. SEDIMENT ACCUMULATION MONITORING

Total depth measurements were collected using an incrementally marked measuring rod placed inside of each cleanout and catch basin to observe the amount of sediment accumulated in the subdrain cleanouts and tightline catch basins. Table 7 summarizes the amount of sediment in these structures in comparison to the original surveyed structure bottom and the performance criteria and also provides some general observations of these structures during the monitoring.

4.1.2. *Treatment Lagoon*

Treatment lagoon performance is measured semiannually with respect to sampling and flow rate and once a year for sediment accumulation. Semiannual monitoring occurs at multiple lagoon inflows, treatment lagoon effluent, and a single compliance point at the Deschutes River, whereas sediment accumulation monitoring occurs on an annual basis at the treatment lagoon.

4.1.2.1. INFLOWS TO LAGOON

The treatment lagoon receives water from four monitored sources:

- Station 350 – SE M Street Storm Drain Outfall
- Station 356 – Upstream Watercourse Inflow from the Wetlands
- Station 360 – Tightline Outfall to Treatment Lagoon
- Station 362 – SE M Street Terminus Catch Basin Outfall

These locations were monitored using the same Global Flow Probe, a rigid incrementally marked tape measure, and dipper for sample collection. The flow probe was used to measure flow rate by placing the probe at the outfall entrance and recording the flow rate. The water level in each outfall was measured using the tape measure. Tables 6A and 6B summarizes the discharge from each of the locations. A sample was also collected from each of the stations (if flowing) by placing the dipper into the discharge.

4.1.2.2. TREATMENT LAGOON EFFLUENT

Treatment lagoon samples were collected using a polyethylene dipper by lowering and submerging the cup portion into the spillway water. Samples were submitted to the same laboratory as the groundwater samples under the same chain of custody procedures, and for the same analyses.

The treatment lagoon effluent (Station 361) is monitored while aeration is actively occurring. Because the lagoon spillway is armored with rip rap, discharge is measured at an outfall approximately 800 feet downstream at a pond located north of the Tumwater Athletic Club where a more accurate flow rate can be determined (Tables 6A and 6B).

4.1.2.3. POINT OF COMPLIANCE

The point of compliance (Station 364) is located at the Deschutes River Outfall located approximately 2,000 feet downstream from the treatment lagoon. This location was monitored and sampled using the same equipment and measuring tools described in the preceding sections. Discharge rate for this station also appears in Tables 6A and 6B.

4.1.2.4. SEDIMENT ACCUMULATION MONITORING

Annual sediment accumulation occurs during the fall monitoring event at three transects through the lagoon. Sedimentation at each of these transects is measured from a boat at 2 foot intervals using a rigid incrementally marked measuring rod and then compared to the original surveyed lagoon depth. Appendix G shows the comparison for the annual monitoring.

4.1.3. *Deviations from the Subdrain and Treatment Lagoon O&M Amendment and QAPP*

The following have been noted as deviations with respect to the Subdrain and Treatment Lagoon O&M Amendment and QAPP:

- Verbal permission to access Cleanout CO-6 (Station 357) for monitoring and sampling could not obtained by the property owner so an alternate cleanout was sampled to represent this location.

Cleanout CO-7 was monitored and sampled as an alternate location for the Spring 2013 monitoring period.

- During the Spring 2013 monitoring event, cleanout CO-8 was not measured because the ground in the back yard was extremely soft and standing water was observed surrounding the cleanout. This made it potentially unsafe for sampling personnel to remove the cleanout lid and take measurements. The backyard also contained multiple shallow trench excavations which appear to be used for draining the area to two separate locations north and south of the house. One week following subdrain monitoring, the occupant indicated that flooding had occurred in the converted garage in October 2012, and that the owner had excavated the trenches and installed the drainage pipes in the backyard to help alleviate the flooding.
- Flow rate at Station 356 was not obtained during the Spring and Fall 2013 monitoring period because this area upstream of the lagoon has become wide and slow and presents a safety hazard for personnel collecting measurements using the procedures outline in the QAPP.
- Flow rates and samples were not collected at Station 362 for both Spring and Fall 2013 because no water was present at this location. This is not an uncommon occurrence for this outfall.
- A grate was installed in front of the culvert located at Station 364 sometime between June 2012 and Spring 2013. This grate prevents beavers from damming the culvert but also disturbs the natural water level and flow through the culvert.
- Sediment accumulation monitoring in the treatment lagoon occurred following a large storm event which overfilled the lagoon and caused the lagoon to flood over its designed capacity.
- Samples collected during the Spring 2013 sampling event were analyzed at a higher reporting limit than the point of compliance RG. The samples collected for the Fall 2013 event were analyzed using a lower reporting limit to meet the RG.

4.2. Subdrain and Treatment Lagoon Monitoring Analytical Results

This section describes the results of the laboratory analysis completed for the Spring and Fall 2013 sampling events. The data validation reports are presented in Appendix C. Laboratory analytical reports are presented in Appendix D. Table 3 and Figures 5 through 8, 11 and 12 summarize PCE and TCE concentrations in groundwater samples collected from piezometers surrounding the subdrain, the subdrain itself, and treatment lagoon locations.

4.2.1. *Data Quality Assessment*

Data quality for both the Spring and Fall 2013 semiannual O&M monitoring was found to be acceptable. A detailed assessment is provided in the data validation reports in Appendix C.

4.2.2. *Piezometers*

The piezometers of interest relative to the subdrain are located near the bluff and in SE Rainier Avenue. The bluff piezometers did not detect TCE or PCE and only one detection of PCE was present at PZ-720 in SE Rainier Avenue for both the Spring and Fall 2013 monitoring events. TCE was detected at three of four piezometers in SE Rainier Avenue. Concentrations of TCE at PZ-720 and PZ-721 were at or exceeded the ROD RG for groundwater during both semiannual events and ranged from 5 to 54 µg/L.

Higher concentrations of TCE occurred during the fall. Additional details on analytical results for the neighborhood piezometers are presented in Section 3.2.4.

4.2.3. *Subdrain*

Concentrations of PCE and TCE were detected in the subdrain during both monitoring events. PCE was detected at all three of the cleanouts sampled during Spring and Fall 2013 and ranged from 4.8 to 10 µg/L. TCE was detected at two of three cleanouts during the spring and all three of the cleanouts during the fall event ranging in concentration from 10 to 16 µg/L.

4.2.4. *Treatment Lagoon*

Monitoring locations for the treatment lagoon are discussed by location including inflows, effluent, and point of compliance.

4.2.4.1. INFLOWS

Inflow results for the treatment lagoon are briefly summarized by location below and in Tables 6A and 6B.

- **Station 350 – SE M Street Storm Drain Outfall:** TCE was detected during spring and fall at 1.4 µg/L or less. PCE was not detected at concentrations greater than the detection limit.
- **Station 356 – Upstream Watercourse from Wetlands:** PCE and TCE were not detected during either monitoring event.
- **Station 360 – Subdrain Tightline Outfall:** PCE and TCE were detected during both monitoring events. PCE was detected at similar concentrations of 4.3 and 5.3 µg/L between spring and fall, respectively. TCE was detected at the same concentration 11 µg/L for both monitoring events.
- **Station 362 – SE M Street Terminus Catch Basin Outfall:** Samples were not collected because there was not flow during both spring and fall.

4.2.4.2. LAGOON EFFLLUENT

Lagoon effluent samples collected post-aeration were just above the TCE detection limit at an estimated 0.83 µg/L in the spring and 0.92 µg/L in the fall.

4.2.4.3. POINT OF COMPLIANCE

At the point of compliance located at the Deschutes River, both PCE and TCE were not detected greater than the reporting limit of 0.5 or 1 µg/L during 2013.

4.2.4.4. RECORD OF DECISION SURFACE WATER DISCHARGE CLEANUP GOALS

Surface water discharge cleanup goals are found in Table 3-1 of the O&M Plan. These are based on the remedial action objective for groundwater ponding as surface water in neighborhood backyards. The objective is to prevent discharge of groundwater containing PCE and TCE in excess of the surface water RG to the Deschutes River. Remediation goals at the point of compliance (Deschutes River) for PCE is 0.8 µg/L and 2.7 µg/L for TCE.

4.3. Conclusions

To better discuss observations and results, the conclusions report have been grouped together by monitoring element such that piezometers, subdrain, tightline, treatment lagoon and effluent, and point of compliance are discussed separately.

4.3.1. *Piezometers*

Water level elevations at the piezometers in SE Rainier Avenue were used to measure reduction in groundwater elevation to determine compliance with the O&M Plan. Groundwater depth in the piezometers in SE Rainier Avenue ranged from half a foot to above ground surface (artesian) at the south end to over three feet below ground surface during the spring in piezometer PZ-720. The fall monitoring period yielded similar results between artesian conditions to water levels exceeding 6 feet below ground surface in SE Rainier Avenue (Figures 9 and 10). A reduction in water table surface elevation to 1.5 feet below the bottom of the crawlspaces (or 3 feet below ground surface) was achieved for the northern portion of the subdrain during the spring monitoring. However, it was not sufficiently reduced to meet the compliance point for the southern portion of the subdrain. Additionally, the subdrain did not meet the water level reduction compliance for the fall monitoring (Table 8).

Crawlspace depth below ground surface under houses west of SE Rainier Avenue is not uniform based on observations from recent air monitoring in the neighborhood. In addition, the piezometers used for measuring depth to groundwater are generally located approximately 50 to 100 feet from the nearest crawlspace access. The distance between the subdrain and the nearest crawlspace access is approximately 10 to 20 feet. Groundwater monitoring points closer to houses may provide more representative groundwater depth for comparison to the performance criterion for the protection of human health.

4.3.2. *Subdrain and Tightline*

This section discusses conclusions relative to the subdrain and tightline and is further divided into discussion on results, discharge rates, and sediment accumulation.

4.3.2.1. RESULTS

PCE and TCE concentrations continue to be the highest in groundwater from Stations 357 (CO-7), 358 (CO-4), 359 (CO-1) and 360, located within the subdrain (Figures 11 and 12). The highest concentrations of PCE and TCE detected during 2013 were both at Station 358 (CO-4). Because the subdrain is capturing and conveying groundwater exceeding the ROD RG, it should continue to remain in operation, however, we suggest it be assessed to optimize its effectiveness.

4.3.2.2. DISCHARGE RATES

Flow rates ranged from 6 to 201 gpm as summarized on Tables 6A and 6B and general observations relative to each location. Interestingly, slow flow, soft bottoms, and organic matter were encountered at multiple locations during both spring and fall monitoring. Because this is a closed system, the discharge from Station 359 at Cleanout CO-1 should be more or less equivalent to the discharge into the treatment lagoon at Station 360. The discrepancy in discharge between the two locations was observed for both 2013 monitoring events and is consistent with past observations since the subdrain monitoring began in 2002.

4.3.2.3. SEDIMENT ACCUMULATION

In August 2013, the City of Tumwater performed maintenance cleaning of the subdrain cleanouts on the main north-south subdrain alignment based upon recommendations provided by EPA, WSDOT, and GeoEngineers from the Spring 2013 monitoring (Table 7). The cleaning was necessary because some of the cleanouts measured during this event exceeded the 1-foot performance criteria for the cleanout sumps. The finger drain cleanouts were not cleaned as part of this maintenance. Sediment accumulation monitoring during the fall indicated that the cleanouts contained less than 1-foot of sediment in the sumps which is acceptable based on O&M performance criteria (Table 6B). Routine cleaning by the City should continue when the O&M performance criteria are not met.

4.3.3. *Treatment Lagoon*

Similar to the preceding section, the treatment lagoon has been divided into separate elements for ease in discussion which include the inflows to the lagoon, the effluent, the compliance point, and sediment accumulation.

4.3.3.1. INFLOWS TO THE TREATMENT LAGOON

Sediment accumulation at each of the three outfalls was not observed during the 2013 monitoring period and flow does not appear to be hampered by the large grasses surrounding the outfalls. PCE was not detected in the samples from Station 350 or 356 indicating these locations are not contributing sources to the treatment lagoon. However, TCE was detected in the samples from Station 350 (SE M Street Storm Drain Outfall) at 1.1 µg/L in Spring 2013, and 1.4 µg/L in Fall 2013. The source of the TCE in the storm drain is unknown.

4.3.3.2. TREATMENT LAGOON EFFLUENT

PCE was not detected at Station 361 (lagoon effluent) during either 2013 sampling event, but TCE was detected at 0.83 µg/L (estimated) and 0.92 µg/L in the treatment lagoon effluent samples collected during the spring and fall events, respectively.

4.3.3.3. POINT OF COMPLIANCE – DESCHUTES RIVER

Station 364 was added to the monitoring network in 2003 to allow further evaluation of the RG at the location where treated water discharges to the Deschutes River. This station is located where the treated water and water from other drainage ways in the area discharge to the Deschutes River, approximately 2,000 feet downstream from the treatment lagoon. PCE and TCE concentrations at Station 364 were not detected or did not exceed the RG of 0.8 µg/L for PCE and 2.7 µg/L for TCE for the 2013 monitoring period.

4.3.3.4. SEDIMENT ACCUMULATION

Sediment accumulation measured on the three transects in the treatment lagoon is presented in Appendix G. When compared to previous sediment accumulation monitoring, the fall measurements indicate that a substantial amount of sediment was removed. No dredging at the treatment lagoon occurred during 2013, however, a large storm event occurred the week before the monitoring. This may have contributed to sediment movement downstream. Based on the transect plots, the elevation of the base of the lagoon appears to be 0.5 to 2 feet lower than earlier measurements in some locations since the previous monitoring in June 2012.

5.0 RECOMMENDATIONS

Based on the results of the 2013 groundwater monitoring activities, provided are recommendations for future groundwater monitoring activities at the Site. It shall be noted that a shallow groundwater investigation is planned to address some data gaps identified previously during the Fall 2013 groundwater and air monitoring events. Although the shallow groundwater will be performed to mostly address air monitoring purposes, it is still considered a groundwater study and will contribute to the overall Site understanding.

The following suggested recommendations are proposed for future groundwater monitoring at the Site:

- Remove MW-96-17 from the ongoing monitoring network. This groundwater monitoring well is a redundant location (same elevation as MW-96-16 and is located nearby), the data collected to date is of questionable quality because of the sample collection method (hand pump) and PCE and TCE has not been detected during any monitoring events.
- Remove either WSDOT-1 or WSDOT-2 from the ongoing monitoring network. Both monitoring wells are screened at same elevation and PCE and TCE has not been detected during any monitoring events.
- Remove piezometers PZ-704, -709, and -715; and all seep locations from the ongoing monitoring network. PCE/TCE has not been detected during any monitoring events.
- Remove MW-ES-08 from the ongoing monitoring network until development of the interim long term monitoring plan or data gaps investigation. Upgradient PCE and TCE has not been detected during any monitoring events.
- Add a Barnes Lake surface water elevation measurement location. This additional data point will assist in comparing groundwater elevations in nearby monitoring wells on the current WSDOT material lab property.
- Decrease ongoing groundwater and subdrain monitoring frequency to one time every nine months. This will allow data that will provide varying seasons (four seasons in three years) to evaluate whether there are seasonal variations in data.
- Modify the Wellfield monitoring locations after TW-5 is abandoned.
- Several existing monitoring wells and piezometers require maintenance and evaluation. Locations to be maintained and/or evaluated will be proposed in the Data Gaps work plan.
- Groundwater monitoring points (potentially additional piezometers) closer to houses west of Rainier Avenue may provide more representative groundwater depth for comparison to the performance criterion for protection of human health.
- To explore the mismatch in flow rates, we suggest the subdrain, finger drains, and tightline be investigated to determine the nature of the flow inconsistencies.
- When compared, the discharge at Station 359, Cleanout CO-1 and Station 360 at the tightline pipe outfall, the flow rates do not match very well. Ideally they would be closer, however, the O&M Plan does not give guidance for an equitable value or tolerance for discharge rates between these two locations. We suggest a better flow measurement method be developed for the outfalls and a better method for collecting flow data for Station 356 be developed so that residence time in the lagoon can be calculated.
- We suggest continuing the sediment accumulation monitoring during the same general timeframe to gather better seasonal information. Additionally, flooding as evidenced by the debris lines on the shore may indicate the amount of water captured and treated by the lagoon exceeded the lagoon capacity expected.

6.0 REFERENCES

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Washington Administrative Code (WAC) 173-160 *Minimum Standards for Construction and Maintenance of Water Wells*.

TABLES

GeoEngineers

Table 1

Well Construction Summary

2013 Annual Groundwater Monitoring Report
Palermo Wellfield Superfund Site
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Well or Piezometer	Well Location [1,2]		Measuring Point (TOC) Elevation [3]	Screen Interval Depth (feet bgs)		Geologic Unit of Screen Interval	Approximate Screen Interval Elevation	
	Northing	Easting		Top	Bottom		Top	Bottom
Bluff Area								
MW-UI	616967.53	1038149.35	178.82	17.7	27.7	unknown	161.1	151.1
WDOT-MW-1	617640.30	1038503.60	166.94	30.0	39.5	SP–dense to medium dense, olive green, fine sand	136.9	127.4
WDOT-MW-2	617572.60	1038517.40	165.45	30.0	39.5	SP–very dense, olive green to orange, fine to medium sand	135.5	126.0
MW-100	616814.53	1037366.22	177.70	20.0	30.0	SP-medium dense, brown, fine to coarse sand	157.7	147.7
MW-101A	617236.76	1038149.35	176.19	65.0	75.0	SP-loose, gray, fine to medium sand	111.3	101.3
MW-101B	617197.00	1038150.00	176.25	25.0	35.0	SP-loose to medium dense, light brown, fine to medium sand	151.2	141.2
MW-102	617465.24	1038134.22	166.94	16.0	26.0	SP-loose to medium dense, gray, fine to medium sand	150.9	140.9
MW-103	617768.90	1038225.10	163.74	11.0	21.0	SP-loose to medium dense, gray, fine to medium sand	152.7	142.7
MW-104A	617861.70	1039673.00	170.64	119.0	129.0	SP-medium dense to dense, brown, fine sand	51.6	41.6
MW-104B	617866.01	1039675.67	170.51	52.0	62.0	SP-medium dense, brown, fine grained sand	118.5	108.5
MW-109	617312.79	1038552.35	168.89	64.5	74.5	SP-medium dense to dense, brown, fine to coarse sand	104.4	94.4
MW-111	617663.43	1038824.43	165.41	30.0	40.0	SP-medium dense, brown, fine to medium sand	135.4	125.4
MW-ES-01[4]	617877.2	1039204.0	173.50	90.0	100.0	SP-outwash sands with silt	83.5	73.5
MW-ES-02	617664.68	1039666.61	174.65	95.0	105.0	SM-silty sand	79.7	69.7
MW-ES-03	617546.79	1039463.97	175.07	113.0	123.0	SP to SP-SM-sand with silt	62.1	52.1
MW-ES-04	617548.74	1039477.60	175.11	50.0	60.0	SM/ML/SM-silty sand, sandy silt, silty sand	125.1	115.1
MW-ES-05	617517.36	1039178.92	175.05	86.0	96.0	SP-SM-fine sand with silt	89.1	79.1
MW-ES-06	617517.59	1039200.03	173.30	46.0	56.0	SP-SM-sand +/- silt	127.3	117.3
MW-ES-07	617139.20	1037976.58	177.89	25.0	35.0	SP-sand SP-sand with gravel	152.9	142.9
MW-ES-08	617163.60	1037049.22	177.17	25.0	35.0	SP-SM-sand +/- silt	152.2	142.2
MW-ES-11	617586.81	1038492.29	166.28	80.0	90.0	SW, well graded sand	86.3	76.3
MW-96-15	617157.91	1038938.73	170.39	69.0	79.0	medium fine sand	101.4	91.4
MW-96-16	616836.42	1039704.25	181.00	50.5	60.5	fine medium sand	130.5	120.5
MW-96-17	616767.70	1039839.20	179.66	45.5	55.5	fine brown sand	134.2	124.2
Deschutes Valley Area								
MW-4A	617599.92	1040464.0	109.86	100	110	silty sand and gravel	9.9	-0.1
MW-4B	617599.9	1040464.0	109.85	80	90	silty sand	29.9	19.9
MW-ES-09	617754.43	1040021.9	108.33	20	30	SP-poorly graded sand with silty sand interbed	88.3	78.3
MW-ES-10	617761.34	1040013.1	108.25	82	92	unknown (no description)	26.3	16.3
MW-107	617052.39	1041164.92	114.66	25.0	35.0	ML-very hard, moist, gray silt SP-loose to medium dense, brown, medium to coarse sand	89.7	79.7
MW-110	618032.42	1041013.21	101.93	30.0	40.0	SP-loose to medium dense, gray, fine to medium sand	71.9	61.9
MW-93-02	617159.33	1040344.31	112.76	6.0	11.0	fine silty blue sand brown clay	106.8	101.8
PZ-704	618088.1	1039827.2	110.61	5	7.5	fine to coarse sand with cobbles and boulders	105.6	103.1
PZ-709	617880	1039819.2	114.27	5	7.5	fine to coarse sand with cobbles and boulders	109.3	106.8
PZ-715	617683.4	1039815.4	117.79	5	7.5	fine to coarse sand with cobbles and boulders	112.8	110.3
PZ-719	618200.7	1039999.7	107.13	7	10	fine to medium sand	100.1	97.1
PZ-720	618026.5	1039992.8	107.95	7	10	fine to medium sand	101.0	98.0
PZ-721	617873.9	1039991.1	108.32	7	10	fine to medium sand	101.3	98.3
PZ-722	617664.1	1039983.3	108.82	7	10	fine to medium sand	101.8	98.8
PZ-723	618244	1040200.4	106.45	7	10	fine to medium sand	99.5	96.5
PZ-724	617976.1	1040198.2	106.56	7	10	fine to medium sand	99.6	96.6
PZ-725	617741.3	1040220.1	108.31	7	10	fine to medium sand	101.3	98.3
PZ-726	618186	1040452.6	105.39	7	10	fine to medium sand	98.4	95.4
PZ-728	617851.61	1040464.0	105.33	7	10	fine to medium sand	98.3	95.3
RPZ-730	618243.76	1040685.0	103.897	4.13	9.13	log not on file	99.8	94.8
RPZ-731	617996.36	1040745.1	105.085	4.75	9.75	log not on file	100.3	95.3
RPZ-732	617731.13	1040684.1	105.687	4.63	9.63	log not on file	101.1	96.1
Palermo Wellfield								
TW-4	617494.23	1040658.29	105.14	60	90	large gravel and sand	45.1	15.1
TW-5	617552.37	1040588.15	106.20	82	115	sand and gravel blue clay at 114 feet	24.2	-8.8
TW-8	617396.92	1040445.80	106.38	70	90	medium to coarse sand and gravel	36.4	16.4

Notes:

[1] Existing well locations and TOC elevations were obtained from previous explorations (Parametrix 2012, URS 1999 and personal communications with EPA 2013).

[2] Horizontal Datum: NAD83 WA State Plane North.

[3] Elevation in NAVD88 = North American Vertical Datum of 1988.

[4] MW-ES-01 no longer exists (abandoned).

bgs = below ground surface

TOC = Top of casing

Table 2

Groundwater Depths and Elevations

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Location	Top-of-Casing Elevation (feet NGVD)	Spring 2013		Fall 2013	
		Depth-to-Water (feet)	Water Level Elevation (feet NGVD)	Depth-to-Water (feet)	Water Level Elevation (feet NGVD)
Monitoring Wells					
MW-4A	109.86	7.67	102.19	5.6	104.26
MW-4B	109.85	7.56	102.29	5.76	104.09
MW-93-02	112.76	4.18	108.58	3.15	109.61
MW-96-15	165.608	24.88	180.68	27.32	138.29
MW-96-16	177.525	46.81	134.19	48.61	128.91
MW-96-17[1]	176.255	48.30	131.36	50	126.26
MW-100	177.7	16.17	161.53	18.82	158.88
MW-101A	176.25	19.10	157.15	21.62	154.63
MW-101B	176.19	18.92	157.27	21.47	154.72
MW-102	166.94	9.77	157.17	12.39	154.55
MW-103	163.74	6.32	157.42	8.71	155.03
MW-104A	170.64	51.96	118.68	50.9	119.74
MW-104B	170.51	49.43	121.08	53.31	117.20
MW-107	114.66	7.96	106.70	8.04	106.62
MW-109	168.89	18.92	149.97	21.56	147.33
MW-110	101.93	2.36	99.57	2.92	99.01
MW-111	165.41	25.29	140.12	27.87	137.54
MW-ES-02	174.65	52.46	122.19	53.94	120.71
MW-ES-03	175.07	47.63	127.44	49.43	125.64
MW-ES-04	175.11	48.00	127.11	49.79	125.32
MW-ES-05	175.05	42.75	132.30	44.85	130.20
MW-ES-06	173.3	43.22	130.08	45.26	128.04
MW-ES-07	177.89	19.61	158.28	22.2	155.69
MW-ES-08	177.17	15.89	161.28	18.57	158.60
MW-ES-09	108.33	-0.13	108.46	0.04	108.29
MW-ES-10	108.25	-1.67	109.92	-1.39	109.64
MW-ES-11	166.28	14.86	151.42	17.61	148.67
MW-UI	178.82	18.81	160.01	21.36	157.46
WDOT-MW-1	166.94	18.66	148.28	21.76	145.18
WDOT-MW-2	165.45	15.13	150.32	17.91	147.54
Piezometers					
PZ-704	110.61	4.42*	106.19	4.53*	106.08
PZ-709	114.27	2.92*	111.35	2.89*	111.38
PZ-715	117.79	4.08*	113.71	4.34*	113.45
PZ-719	107.13	2.06	105.07	7.39	99.74
PZ-720	107.95	3.10	104.85	2.03	105.92
PZ-721	108.32	2.55	105.77	6.36	101.96
PZ-722	108.82	-0.93	109.75	-0.87	109.69
PZ-723	106.45	2.41	104.04	6.81	99.64
PZ-724	106.56	1.06	105.50	6.72	99.84
PZ-725	108.31	2.25	106.06	2.64	105.67
PZ-726	105.39	2.82	102.57	6.98	98.41
PZ-728	105.33	2.29	103.04	6.68	98.65
RPZ-730	103.897	2.92	100.94	3.48	100.42
RPZ-731	105.085	3.72	101.33	4.42	100.66
RPZ-732	105.687	4.44	101.21	4.79	100.90
Production Wells					
TW-4	105.49	24.15	81.34	6.90	98.59
TW-5	107.97	55.40	52.57	8.60	99.37
TW-8	106.48	35.00	71.48	4.85	101.63

Notes:

[1] Water level measured through top of hand pump.

*Depth to water measurement was taken from an above ground surface top of casing. The associated groundwater elevation has been adjusted to account for the sticku

NGVD = National Geodetic Vertical Datum 1929

Groundwater depth-to-water measurements were collected from monitoring wells on March 4 and 6, 2013, and September 16, 19, 23, and 25, 2013.

Subdrain depth-to-water measurements were collected on March 8, 2013 and October 3, 2013.

Table 3

TCE and PCE Detected in Groundwater and Seep Samples

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	Analyte	Tetrachloroethene	Trichloroethene
	ROD Remediation Goal	5	5
Location ID	Date	(µg/L)	(µg/L)
MW-100	5/12/2004	0.5 U	0.5 U
MW-100	9/21/2004	1 U	0.5 U
MW-100	4/26/2005	0.5 U	0.5 U
MW-100	10/5/2005	0.5 U	0.5 U
MW-100	3/16/2006	1 U	1 U
MW-100	10/30/2006	1 U	1 U
MW-100	6/6/2007	1 U	1 U
MW-100	11/12/2007	1 U	1 U
MW-100	5/19/2008	0.5 U	0.5 U
MW-100	10/27/2008	1 U	1 U
MW-100	4/27/2009	0.5 U	0.5 U
MW-100	11/9/2009	0.5 U	0.5 U
MW-100	5/19/2010	0.5 U	0.5 U
MW-100	10/19/2010	0.5 U	0.5 U
MW-100	5/23/2011	0.5 U	0.5 U
MW-100	11/8/2011	0.5 U	0.5 U
MW-100	5/29/2012	0.5 U	0.5 U
MW-100	3/5/2013	1 U	1 U
MW-100	9/19/2013	0.5 U	0.5 U
MW-101A	3/17/2006	1 U	1 U
MW-101A	5/29/2012	0.5 U	0.5 U
MW-101A	3/6/2013	1 U	1 U
MW-101A	9/17/2013	0.5 U	0.5 U
MW-101B (dup)	11/10/2009	0.5 U	2.2
MW-101B (dup)	5/19/2010	0.5 U	3.5
MW-101B (dup)	10/21/2010	0.5 U	3.3
MW-101B	3/17/2006	0.1 J	14
MW-101B	10/31/2006	1 U	6.2
MW-101B	6/6/2007	1 U	5.5
MW-101B	11/13/2007	1 U	5.7
MW-101B	5/20/2008	0.5 U	6.2
MW-101B	10/28/2008	1 U	3.9
MW-101B	4/28/2009	0.5 U	17
MW-101B	11/10/2009	0.5 U	2
MW-101B	5/19/2010	0.5 U	3.6
MW-101B	10/21/2010	0.5 U	3.3
MW-101B	5/24/2011	0.5 U	2.2
MW-101B	11/8/2011	0.5 U	3.7
MW-101B	5/29/2012	0.5 U	2.7
MW-101B	3/5/2013	1 U	3
MW-101B	9/17/2013	0.5 U	3.3
MW-102 (dup)	6/4/2012	0.5 U	0.5 U
MW-102	6/4/2012	0.5 U	0.5 U
MW-102	3/5/2013	1 U	1 U
MW-102	9/17/2013	0.5 U	0.5 U
MW-103	6/4/2012	0.5 U	0.5 U
MW-103	3/6/2013	1 U	1 U
MW-103	9/18/2013	0.5 U	0.5 U
MW-104A	3/17/2006	1 U	6.6
MW-104A	10/31/2006	1.7	1 U
MW-104A	6/4/2012	0.5 U	5.3
MW-104A	3/7/2013	1 U	8
MW-104A	9/27/2013	0.5 U	4.6
MW-104B	5/11/2004	1.9	0.26 J
MW-104B	9/21/2004	1.6	0.5 U
MW-104B	4/26/2005	0.97	0.5 U
MW-104B	10/6/2005	0.09	0.5 U
MW-104B	3/16/2006	1.5	1 U
MW-104B	10/31/2006	1 U	11
MW-104B	6/7/2007	1.9	1 U
MW-104B	11/13/2007	2.4	1 U
MW-104B	5/20/2008	1.3	0.5 U
MW-104B	10/28/2008	1.6	1 U
MW-104B	4/29/2009	5 U	5 U
MW-104B	11/11/2009	0.87	0.5 U
MW-104B	5/20/2010	1.4	0.057 J
MW-104B	10/22/2010	1.8	0.5 U
MW-104B	5/26/2011	0.95	0.5 U
MW-104B	11/9/2011	1.6	0.5 U
MW-104B	6/4/2012	0.5	0.5 U
MW-104B	3/11/2013	1.4	1 U
MW-104B	9/27/2013	1.5	0.5 U
MW-107	6/7/2012	0.5 U	0.5 U
MW-107	3/6/2013	1 U	1 U
MW-107	9/20/2013	0.5 U	0.5 U

	Analyte	Tetrachloroethene	Trichloroethene
	ROD Remediation Goal	5	5
Location ID	Date	(µg/L)	(µg/L)
MW-109 (dup)	3/20/2006	1 U	27
MW-109 (dup)	11/1/2006	1 U	25
MW-109 (dup)	5/20/2008	0.5 U	22 J
MW-109	5/12/2004	0.5 U	31
MW-109	9/21/2004	1 U	32
MW-109	4/26/2005	0.5 U	15
MW-109	10/5/2005	0.5 U	22
MW-109	3/20/2006	1 U	26
MW-109	11/1/2006	1 U	25
MW-109	6/7/2007	1 U	22
MW-109	11/13/2007	1 U	22
MW-109	5/20/2008	0.5 U	10
MW-109	10/28/2008	1 U	20
MW-109	4/28/2009	0.5 U	17
MW-109	11/10/2009	0.5 U	8.3
MW-109	5/19/2010	0.5 U	16
MW-109	10/21/2010	0.5 U	17
MW-109	5/24/2011	0.5 U	13
MW-109	11/8/2011	0.5 U	19
MW-109	5/30/2012	0.5 U	13
MW-109	3/5/2013	1 U	15
MW-109	9/18/2013	0.5 U	16
MW-110 (dup)	6/7/2012	0.5 U	0.5 U
MW-110 (dup)	3/6/2013	1 U	1 U
MW-110	5/12/2004	0.5 U	0.5 U
MW-110	9/21/2004	1 U	0.5 U
MW-110	4/26/2005	0.5 U	0.5 U
MW-110	10/5/2005	0.5 U	0.5 U
MW-110	3/15/2006	1 U	26
MW-110	10/31/2006	1 U	1 U
MW-110	6/6/2007	1 U	1 U
MW-110	11/12/2007	1 U	1 U
MW-110	5/20/2008	0.5 U	0.5 U
MW-110	10/28/2008	1 U	1 U
MW-110	4/28/2009	0.5 U	0.5 U
MW-110	11/10/2009	0.5 U	0.5 U
MW-110	5/19/2010	0.5 U	0.5 U
MW-110	10/20/2010	0.5 U	0.5 U
MW-110	5/24/2011	0.5 U	0.5 U
MW-110	11/8/2011	0.5 U	0.5 U
MW-110	6/7/2012	0.5 U	0.5 U
MW-110	3/6/2013	1 U	1 U
MW-110	9/20/2013	0.5 U	0.5 U
MW-111 (dup)	11/13/2007	1 U	18
MW-111 (dup)	10/28/2008	1 U	16
MW-111 (dup)	5/24/2011	0.5 U	11
MW-111	5/12/2004	0.5 U	22
MW-111	9/21/2004	1 U	17
MW-111	4/26/2005	0.5 U	0.5 U
MW-111	10/5/2005	0.5 U	12
MW-111	3/17/2006	1 U	20
MW-111	11/1/2006	1 U	16
MW-111	6/6/2007	1 U	18
MW-111	11/13/2007	1 U	16
MW-111	5/20/2008	0.5 U	14
MW-111	10/28/2008	1 U	17
MW-111	4/28/2009	0.5 U	11
MW-111	11/10/2009	0.5 U	5.8
MW-111	5/19/2010	0.5 U	12
MW-111	10/21/2010	0.5 U	11
MW-111	5/24/2011	0.5 U	12
MW-111	11/8/2011	0.5 U	13
MW-111	5/30/2012	0.5 U	12
MW-111	3/7/2013	1 U	9.1
MW-111	9/19/2013	0.5 U	9.2
MW-4A	3/20/2006	1 U	1 U
MW-4A	6/5/2012	0.5 U	0.5 U
MW-4A	3/12/2013	1 U	1 U
MW-4A	9/26/2013	0.5 U	0.5 U
MW-4B (dup)	9/26/2013	0.5 U	0.5 U
MW-4B	3/20/2006	1 U	1 U
MW-4B	6/5/2012	0.5 U	0.5 U
MW-4B	3/12/2013	1 U	1 U
MW-4B	9/26/2013	0.5 U	0.5 U
MW-93-02	6/5/2012	0.5 U	0.5 U
MW-93-02	3/12/2013	1 U	1 U
MW-93-02	9/20/2013	0.5 U	0.5 U
MW-96-15	5/30/2012	0.5 U	0.5 U
MW-96-15	3/7/2013	1 U	1 U
MW-96-15	9/17/2013	0.5 U	0.5 U
MW-96-16	6/5/2012	0.5 U	0.5 U
MW-96-16	3/6/2013	1 U	1 U
MW-96-16	9/18/2013	0.5 U	0.5 U
MW-96-17	6/5/2012	0.5 U	0.5 U
MW-96-17	3/6/2013	1 U	1 U
MW-96-17	9/18/2013	0.5 U	0.5 U

	Analyte	Tetrachloroethene	Trichloroethene
	ROD Remediation Goal	5	5
Location ID	Date	(µg/L)	(µg/L)
MW-ES-02 (dup)	11/1/2006	1 U	69
MW-ES-02 (dup)	11/14/2007	1 U	62
MW-ES-02 (dup)	11/8/2011	0.5 U	50
MW-ES-02 (dup)	5/31/2012	0.5 U	50
MW-ES-02	3/22/2006	1 U	56
MW-ES-02	11/1/2006	1 U	68
MW-ES-02	6/7/2007	1 U	66
MW-ES-02	11/14/2007	1 U	66
MW-ES-02	5/20/2008	0.5 U	47
MW-ES-02	10/29/2008	1 U	50
MW-ES-02	4/29/2009	5 U	43
MW-ES-02	11/11/2009	0.5 U	29
MW-ES-02	5/20/2010	0.5 U	53
MW-ES-02	10/22/2010	0.5 U	58
MW-ES-02	5/26/2011	0.5 U	46
MW-ES-02	11/8/2011	0.5 U	51
MW-ES-02	5/31/2012	0.5 U	47
MW-ES-02	3/7/2013	1 U	38
MW-ES-02	9/20/2013	0.5 U	39
MW-ES-03 (dup)	5/11/2004	0.5 U	37
MW-ES-03 (dup)	9/22/2004	1 U	40
MW-ES-03 (dup)	4/27/2005	0.5 U	18
MW-ES-03 (dup)	10/6/2005	0.13 J	22
MW-ES-03 (dup)	3/7/2013	1 U	20
MW-ES-03	5/11/2004	0.5 U	37
MW-ES-03	9/22/2004	1 U	42
MW-ES-03	4/27/2005	0.5 U	22
MW-ES-03	10/6/2005	1.4	0.5 U
MW-ES-03	3/20/2006	1 U	27
MW-ES-03	11/1/2006	1 U	22
MW-ES-03	6/7/2007	1 U	26
MW-ES-03	11/14/2007	1 U	26
MW-ES-03	5/21/2008	0.5 U	24
MW-ES-03	10/29/2008	1 U	25
MW-ES-03	4/29/2009	5 U	16
MW-ES-03	11/12/2009	0.5 U	12
MW-ES-03	5/20/2010	0.5 U	21
MW-ES-03	10/21/2010	0.5 U	25
MW-ES-03	5/25/2011	0.5 U	21
MW-ES-03	11/9/2011	0.5 U	27
MW-ES-03	6/4/2012	0.5 U	21
MW-ES-03	3/7/2013	1 U	17
MW-ES-03	9/19/2013	0.5 U	18
MW-ES-04 (dup)	3/20/2006	49	0.7 J
MW-ES-04	5/11/2004	58	0.52
MW-ES-04	9/22/2004	52	0.44 J
MW-ES-04	4/27/2005	51	0.35 J
MW-ES-04	10/6/2005	38	0.24 J
MW-ES-04	3/20/2006	48	0.8 J
MW-ES-04	11/1/2006	43	1.2
MW-ES-04	6/7/2007	35	1.2
MW-ES-04	11/14/2007	38	1.7
MW-ES-04	5/21/2008	49	1.8
MW-ES-04	10/29/2008	25	1.1
MW-ES-04	4/29/2009	21	0.56 J
MW-ES-04	11/12/2009	16	0.38 J
MW-ES-04	5/20/2010	42	0.64 J
MW-ES-04	10/21/2010	34	0.6
MW-ES-04	5/25/2011	23	0.52
MW-ES-04	11/9/2011	26	0.75
MW-ES-04	6/4/2012	31	0.82
MW-ES-04	3/8/2013	44	0.56 J
MW-ES-04	9/19/2013	32	0.5 U
MW-ES-05 (dup)	5/21/2008	0.5 U	56 J
MW-ES-05 (dup)	9/20/2013	0.5 U	27
MW-ES-05	5/11/2004	0.5 U	46 J
MW-ES-05	9/22/2004	1 U	44
MW-ES-05	4/26/2005	0.5 U	52
MW-ES-05	10/5/2005	0.5 U	37
MW-ES-05	3/21/2006	1 U	46
MW-ES-05	11/1/2006	1 U	58
MW-ES-05	6/7/2007	1 U	54
MW-ES-05	11/13/2007	1 U	53
MW-ES-05	5/21/2008	0.21 J	58
MW-ES-05	10/29/2008	1 U	41
MW-ES-05	4/29/2009	5 U	27
MW-ES-05	11/11/2009	0.5 U	16
MW-ES-05	5/20/2010	0.5 U	33
MW-ES-05	10/22/2010	0.5 U	36
MW-ES-05	5/25/2011	0.5 U	30
MW-ES-05	11/9/2011	0.5 U	35
MW-ES-05	5/30/2012	0.5 U	32
MW-ES-05	3/8/2013	1 U	27
MW-ES-05	9/20/2013	0.5 U	27

	Analyte	Tetrachloroethene	Trichloroethene
	ROD Remediation Goal	5	5
Location ID	Date	(µg/L)	(µg/L)
MW-ES-06 (dup)	4/29/2009	18	3.5 J
MW-ES-06	5/11/2004	31	11
MW-ES-06	9/22/2004	26	11
MW-ES-06	4/26/2005	15	4.6
MW-ES-06	10/5/2005	19	11
MW-ES-06	3/21/2006	25	16
MW-ES-06	11/1/2006	34	12
MW-ES-06	6/7/2007	49	6.1
MW-ES-06	11/13/2007	40	6.9
MW-ES-06	5/21/2008	16	4.7
MW-ES-06	10/29/2008	18	5.7
MW-ES-06	4/29/2009	16	5 U
MW-ES-06	11/11/2009	11	2.3
MW-ES-06	5/20/2010	18	3.1
MW-ES-06	10/22/2010	14	2.7
MW-ES-06	5/25/2011	26	1.2
MW-ES-06	11/9/2011	36	1.6
MW-ES-06	5/30/2012	34	1.2
MW-ES-06	3/8/2013	23	0.97 J
MW-ES-06	9/20/2013	27	0.76
MW-ES-07	3/20/2006	0.1 J	7.8
MW-ES-07	10/31/2006	1 U	11
MW-ES-07	6/6/2007	1 U	10
MW-ES-07	11/13/2007	1 U	11
MW-ES-07	5/20/2008	0.5 U	8.6
MW-ES-07	10/28/2008	1 U	6.9
MW-ES-07	4/28/2009	0.5 U	4.7
MW-ES-07	11/10/2009	0.5 U	3.6
MW-ES-07	5/19/2010	0.5 U	4.8
MW-ES-07	10/21/2010	0.5 U	5.1
MW-ES-07	5/24/2011	0.5 U	4.5
MW-ES-07	11/8/2011	0.5 U	9.7
MW-ES-07	5/29/2012	0.5 U	4.4
MW-ES-07	3/5/2013	1 U	3.9
MW-ES-07	9/17/2013	0.5 U	7
MW-ES-08	5/29/2012	0.5 U	0.5 U
MW-ES-08	3/5/2013	1 U	1 U
MW-ES-08	9/19/2013	0.5 U	0.5 U
MW-ES-09 (dup)	10/29/2008	1 U	150
MW-ES-09 (dup)	11/11/2009	0.5 U	70
MW-ES-09 (dup)	5/21/2010	0.5 U	150
MW-ES-09 (dup)	5/26/2011	0.5 U	120
MW-ES-09	5/11/2004	0.5 U	220
MW-ES-09	9/22/2004	1 U	200
MW-ES-09	4/27/2005	0.5 U	300
MW-ES-09	10/6/2005	0.5 U	120
MW-ES-09	3/22/2006	1 U	176
MW-ES-09	11/2/2006	1 U	170
MW-ES-09	6/8/2007	1 U	169
MW-ES-09	11/14/2007	1 U	160
MW-ES-09	5/21/2008	0.5 U	150
MW-ES-09	10/29/2008	1 U	150
MW-ES-09	4/30/2009	5 U	140
MW-ES-09	11/11/2009	0.5 U	73
MW-ES-09	5/21/2010	0.5 U	150
MW-ES-09	10/22/2010	0.5 U	130
MW-ES-09	5/26/2011	0.5 U	120
MW-ES-09	11/9/2011	0.5 U	150
MW-ES-09	6/5/2012	0.5 U	150 J
MW-ES-09	3/11/2013	1 U	120
MW-ES-09	9/26/2013	1 U	120
MW-ES-10 (dup)	4/30/2009	5 U	46
MW-ES-10 (dup)	10/22/2010	0.5 U	54
MW-ES-10 (dup)	11/9/2011	0.5 U	54
MW-ES-10	5/11/2004	0.5 U	83
MW-ES-10	9/22/2004	1 U	83
MW-ES-10	4/27/2005	0.5 U	78
MW-ES-10	10/6/2005	0.5 U	75
MW-ES-10	3/22/2006	1 U	65
MW-ES-10	11/2/2006	1 U	68
MW-ES-10	6/8/2007	1 U	63
MW-ES-10	11/14/2007	1 U	61
MW-ES-10	5/21/2008	0.5 U	46
MW-ES-10	10/29/2008	1 U	52
MW-ES-10	4/30/2009	5 U	34
MW-ES-10	11/11/2009	0.5 U	29
MW-ES-10	5/21/2010	0.5 U	53
MW-ES-10	10/22/2010	0.5 U	52
MW-ES-10	5/26/2011	0.5 U	36
MW-ES-10	11/9/2011	0.5 U	53
MW-ES-10	6/5/2012	0.5 U	67 J
MW-ES-10	3/11/2013	1 U	37
MW-ES-10	9/26/2013	0.5 U	36
MW-ES-11 (dup)	9/17/2013	0.5 U	0.5 U
MW-ES-11	5/31/2012	0.5 U	0.5 U
MW-ES-11	3/6/2013	1 U	1 U
MW-ES-11	9/17/2013	0.5 U	0.5 U

	Analyte	Tetrachloroethene	Trichloroethene
	ROD Remediation Goal	5	5
Location ID	Date	(µg/L)	(µg/L)
MW-UI	5/12/2004	0.5 U	21 J
MW-UI	9/21/2004	1 U	17
MW-UI	4/26/2005	0.5 U	8.8
MW-UI	10/5/2005	0.5 U	3.6
MW-UI	3/17/2006	1 U	5.2
MW-UI	10/31/2006	1 U	12
MW-UI	6/6/2007	1 U	23
MW-UI	11/12/2007	1 U	28
MW-UI	5/19/2008	0.5 U	16
MW-UI	10/28/2008	1 U	8.3
MW-UI	4/27/2009	0.5 U	7.9
MW-UI	11/10/2009	0.5 U	3.8
MW-UI	5/19/2010	0.5 U	7.8
MW-UI	10/19/2010	0.5 U	8.1
MW-UI	5/24/2011	0.5 U	11
MW-UI	11/8/2011	0.5 U	11
MW-UI	5/29/2012	0.5 U	9.3
MW-UI	3/5/2013	1 U	8.1
MW-UI	9/19/2013	0.5 U	6.6
PZ-704	6/6/2012	0.5 U	0.5 U
PZ-704	3/13/2013	1 U	1 U
PZ-704	9/23/2013	0.5 U	0.5 U
PZ-709	6/6/2012	0.5 U	0.5 U
PZ-709	3/13/2013	1 U	1 U
PZ-709	9/23/2013	0.2 UJ	0.2 UJ
PZ-715	6/6/2012	0.5 U	0.5 U
PZ-715	3/13/2013	1 U	1 U
PZ-715	9/23/2013	0.5 U	0.5 U
PZ-719 (dup)	3/14/2013	1 U	1.5
PZ-719	6/6/2012	0.5 U	1.7
PZ-719	3/14/2013	1 U	1.6
PZ-719	9/24/2013	0.5 U	2.1
PZ-720	2/1/2004	1.1	17
PZ-720	6/6/2012	0.5 U	6.6 J
PZ-720	3/14/2013	0.38 J	5
PZ-720	9/24/2013	0.55	9.7
PZ-721 (dup)	9/24/2013	0.5 U	54
PZ-721	2/1/2004	0.79	98
PZ-721	3/15/2006	0.4 J	47
PZ-721	11/2/2006	0.69 J	59
PZ-721	6/5/2007	1 U	35
PZ-721	11/14/2007	0.53 J	52
PZ-721	5/21/2008	0.39 J	41
PZ-721	10/27/2008	1 U	19
PZ-721	4/30/2009	5 U	35
PZ-721	11/11/2009	0.5 U	27
PZ-721	5/19/2010	0.2 J	41
PZ-721	10/20/2010	0.5 U	48
PZ-721	5/26/2011	0.5 U	30
PZ-721	6/6/2012	0.5 U	38
PZ-721	3/14/2013	1 U	30
PZ-721	9/24/2013	0.5 U	54
PZ-722	6/6/2012	0.5 U	0.5 U
PZ-722	3/14/2013	1 U	1 U
PZ-722	9/25/2013	0.5 U	0.5 U
PZ-723 (dup)	6/6/2012	0.5 U	0.5 U
PZ-723	6/6/2012	0.5 U	0.5 U
PZ-723	3/14/2013	1 U	1 U
PZ-723	9/25/2013	0.5 U	0.5 U
PZ-724	2/1/2004	0.45 J	39
PZ-724	3/15/2006	0.3 J	28
PZ-724	11/2/2006	1 U	37
PZ-724	6/5/2007	1 U	15
PZ-724	11/14/2007	1 U	32
PZ-724	5/21/2008	0.22 J	87
PZ-724	10/27/2008	1 U	44
PZ-724	4/30/2009	5 U	35
PZ-724	11/11/2009	0.5 U	28
PZ-724	5/19/2010	0.5 U	34
PZ-724	10/20/2010	0.5 U	43
PZ-724	5/26/2011	0.5 U	30
PZ-724	6/7/2012	0.5 U	13
PZ-724	3/14/2013	1 U	32
PZ-724	9/25/2013	0.5 U	43
PZ-725	2/1/2004	0.5 U	0.35 J
PZ-725	6/8/2012	0.5 U	0.5 U
PZ-725	3/14/2013	1 U	1 U
PZ-725	9/24/2013	0.5 U	0.5 U
PZ-726	2/1/2004	0.5 U	3.1
PZ-726	3/15/2006	1 U	24
PZ-726	6/8/2012	0.5 U	3.4 J
PZ-726	3/12/2013	1 U	2.7
PZ-726	9/25/2013	0.5 U	3.8

	Analyte	Tetrachloroethene	Trichloroethene
	ROD Remediation Goal	5	5
Location ID	Date	(µg/L)	(µg/L)
PZ-728	2/1/2004	0.5 U	31
PZ-728	11/2/2006	1 U	16
PZ-728	6/5/2007	1 U	18
PZ-728	11/14/2007	1 U	21
PZ-728	5/21/2008	0.5 U	14
PZ-728	10/27/2008	1 U	51
PZ-728	4/30/2009	5 U	9.1
PZ-728	11/11/2009	0.5 U	8.2
PZ-728	5/19/2010	0.5 U	10
PZ-728	10/20/2010	0.5 U	12
PZ-728	5/26/2011	0.5 U	6
PZ-728	6/8/2012	0.5 U	4.5 J
PZ-728	3/7/2013	1 U	4.7
PZ-728	9/25/2013	0.5 U	5.1
RPZ-730	6/4/2012	0.5 U	0.5 U
RPZ-730	3/13/2013	1 U	1 U
RPZ-730	9/24/2013	0.5 U	0.5 U
RPZ-731	6/4/2012	0.5 U	0.61
RPZ-731	3/13/2013	1 U	0.6 J
RPZ-731	9/24/2013	0.5 U	1.6
RPZ-732	6/5/2012	0.5 U	0.5 U
RPZ-732	3/12/2013	1 U	1 U
RPZ-732	9/24/2013	0.5 U	0.5 U
Seep 1	5/30/2012	0.5 U	0.5 U
Seep 1	3/19/2013	1 U	1 U
Seep 1	10/2/2013	0.5 U	0.5 U
Seep 2	5/30/2012	0.5 U	0.5 U
Seep 2	3/19/2013	1 U	1 U
Seep 2	10/2/2013	0.5 U	0.5 U
Seep 3	5/31/2012	0.5 U	0.5 U
Seep 3	3/19/2013	1 U	1 U
Seep 3	10/2/2013	0.5 U	0.5 U
Seep 5 (dup)	3/19/2013	1 U	1 U
Seep 5 (dup)	10/2/2013	0.5 U	0.5 U
Seep 5	5/31/2012	0.5 U	0.5 U
Seep 5	5/31/2012	0.5 U	0.5 U
Seep 5	3/19/2013	1 U	1 U
Seep 5	10/2/2013	0.5 U	0.5 U
ST-1	6/5/2007	1.0 U	1.0 U
ST-1	11/14/2007	1.0 U	1.0 U
ST-1	5/21/2008	0.5 U	0.5 U
ST-1	10/29/2008	1.0 U	1.0 U
ST-1	5/23/2011	0.5 U	0.5 U
ST-1	11/7/2011	0.5 U	0.5 U
ST-2	6/5/2007	1.0 U	1.0 U
ST-2	11/14/2007	1.0 U	1.0 U
ST-2	5/21/2008	0.5 U	0.5 U
ST-2	4/29/2009	0.5 U	0.5 U
ST-2	11/10/2009	0.5 U	0.5 U
ST-2	5/18/2010	0.5 U	0.5 U
ST-2	10/20/2010	0.5 U	0.5 U
ST-2	6/11/2012	0.5 U	0.5 U
ST-2	3/7/2013	1.0 U	1.0 U
ST-2	9/18/2013	0.5 U	0.5 U
TW-4	3/15/2006	1.0 U	3.4
TW-4	11/2/2006	1.0 U	2.1
TW-4	6/4/2007	1.0 U	3.3
TW-4	11/14/2007	1.0 U	2.2
TW-4	5/21/2008	0.5 U	0.61
TW-4	10/29/2008	1.0 U	1.3
TW-4	4/30/2009	0.5 U	1.3
TW-4	11/10/2009	0.5 U	0.85
TW-4	5/18/2010	0.5 U	1.1
TW-4	10/20/2010	0.5 U	0.76
TW-4	5/23/2011	0.5 U	0.5 U
TW-4	11/7/2011	0.5 U	0.5 U
TW-4	6/11/2012	0.5 U	0.71 J
TW-4	3/7/2013	1.0 U	1.7
TW-4	9/18/2013	0.5 U	1.3
TW-5	3/15/2006	1.0 U	7.4
TW-5	11/2/2006	1.0 U	6.5
TW-5	6/5/2007	1.0 U	10
TW-5	11/14/2007	1.0 U	8.4
TW-5	5/21/2008	0.5 U	3.8
TW-5	10/29/2008	1.0 U	3.7
TW-5	4/29/2009	0.5 U	2.5
TW-5	11/10/2009	0.5 U	1.1
TW-5	5/18/2010	0.5 U	1.2
TW-5	10/20/2010	0.5 U	0.5 U
TW-5	5/23/2011	0.5 U	0.5 U
TW-5	11/7/2011	0.5 U	0.5 U
TW-5	6/11/2012	0.5 U	0.5 U
TW-5	3/7/2013	1.0 U	1.0 U
TW-5	9/18/2013	0.5 U	0.5 U

	Analyte	Tetrachloroethene	Trichloroethene
	ROD Remediation Goal	5	5
Location ID	Date	(µg/L)	(µg/L)
TW-8	6/11/2012	0.5 U	0.5 U
TW-8	3/7/2013	1.0 U	1.0 U
TW-8	9/18/2013	0.5 U	0.5 U
WDOT-MW-1	5/31/2012	0.5 U	0.5 U
WDOT-MW-1	3/7/2013	1 U	1 U
WDOT-MW-1	9/18/2013	0.5 U	0.5 U
WDOT-MW-2	5/31/2012	0.5 U	0.5 U
WDOT-MW-2	3/6/2013	1 U	1 U
WDOT-MW-2	9/18/2013	0.5 U	0.5 U

Notes:

µg/L = microgram per liter

J = detected above the method detection limit but below the reporting limit

dup = field duplicate sample

U = not detected at or above the reporting limit

NG = no remediation goal

Bold font type indicates the analyte was detected above the reporting limit.

Gray shading indicates the analyte was detected above the ROD Remediation Goal.

Samples were also analyzed for 1,1-DCE, trans-1,2-DCE, cis-1,2-DCE and vinyl chloride.

Table 4

Mann-Kendall Statistical Trends
2013 Annual Groundwater Monitoring Report
Palermo Wellfield Superfund Site
Tumwater, Washington

Location ID	Total Number of VOC Samples Collected*	Date of Most Recent Sample	PCE Maximum Concentration Detected* (µg/L)/Date	General Long Term PCE Concentration Statistical Trend (95 Percent Confidence Limit)	TCE Maximum Concentration Detected* (µg/L)/ Date	General Long Term TCE Concentration Statistical Trend (95 percent confidence limit)
MW-101B	15	9/17/2013	0.1 / Mar 2006	No Statistically Significant Trend.	17 / Apr 2009	Decreasing
MW-104A	5	9/27/2013	1.7 / Oct 2006	No Statistically Significant Trend.	8 / Mar 2013	No Statistically Significant Trend.
MW-104B	19	9/27/2013	2.4 / Nov 2007	No Statistically Significant Trend.	11 / Oct 2006	No Statistically Significant Trend.
MW-109	19	9/18/2013	ND	No Statistically Significant Trend. PCE Not Detected.	32 / Sep 2004	Decreasing
MW-110	19	9/20/2013	ND	No Statistically Significant Trend. PCE Not Detected.	26 / Mar 2006	No Statistically Significant Trend.
MW-111	19	9/19/2013	ND	No Statistically Significant Trend. PCE Not Detected.	22 / May 2004	Decreasing
MW-UI	19	9/19/2013	ND	No Statistically Significant Trend. PCE Not Detected.	28 / Nov 2007	No Statistically Significant Trend.
MW-ES-02	15	9/20/2013	ND	No Statistically Significant Trend. PCE Not Detected.	78 / May 2008	Decreasing
MW-ES-03	19	9/19/2013	1.4 / Oct 2005	No Statistically Significant Trend.	42 / Sep 2004	Decreasing
MW-ES-04	19	9/19/2013	60 / Apr 2005	Decreasing	2.1 / May 2008	No Statistically Significant Trend.
MW-ES-05	19	9/20/2013	0.21 / May 2008	Decreasing	58 / Nov 2006	Decreasing
MW-ES-06	19	9/20/2013	49 / Jun 2007	No Statistically Significant Trend.	16 / Mar 2006	Decreasing
MW-ES-07	15	9/17/2013	0.1 / Mar 2006	No Statistically Significant Trend.	11 / Nov 2007	Decreasing
MW-ES-09	19	9/26/2013	ND	No Statistically Significant Trend. PCE Not Detected.	340 / Apr 2005	Decreasing
MW-ES-10	19	9/26/2013	ND	No Statistically Significant Trend. PCE Not Detected.	83 / Sep 2004	Decreasing
PZ-719	4	9/24/2013	ND	No Statistically Significant Trend. PCE Not Detected.	2.1 / Sep 2013	No Statistically Significant Trend.
PZ-720	5	9/24/2013	1.1 / Feb 2004	No Statistically Significant Trend.	17 / Feb 2004	No Statistically Significant Trend.
PZ-721	16	9/24/2013	0.79 / Feb 2004	No Statistically Significant Trend.	98 / Feb 2004	No Statistically Significant Trend.
PZ-724	16	9/25/2013	0.45 / Feb 2004	No Statistically Significant Trend.	87 / May 2008	No Statistically Significant Trend.
PZ-725	5	9/24/2013	ND	No Statistically Significant Trend. PCE Not Detected.	0.35 / Feb 2004	No Statistically Significant Trend.
PZ-726	6	9/25/2013	ND	No Statistically Significant Trend. PCE Not Detected.	24 / Mar 2006	No Statistically Significant Trend.
PZ-728	15	9/25/2013	ND	No Statistically Significant Trend. PCE Not Detected.	51 / Oct 2008	No Statistically Significant Trend.
RPZ-731	4	9/24/2013	ND	No Statistically Significant Trend. PCE Not Detected.	1.6 / Mar 2006	No Statistically Significant Trend.
TW-4	15	9/18/2013	ND	No Statistically Significant Trend. PCE Not Detected.	3.4 / Mar 2006	Decreasing
TW-5	15	9/18/2013	ND	No Statistically Significant Trend. PCE Not Detected.	10 / Jun 2007	Decreasing

Notes:

*Since long term monitoring began in 2004.

ND = Compound not detected.

Table 5

Neighborhood Piezometer Elevations

2013 Annual Groundwater Monitoring Report
Palermo Wellfield Superfund Site
Tumwater, Washington

Location	Top-of-Casing Elevation (feet NGVD)[1]	Ground Surface Elevation (feet NGVD)[1]	Spring 2013		Fall 2013	
			Depth to Water March 4, 2013 (feet BTOC)	Groundwater Elevation (feet NGVD)	Depth to Water September 16 and 23, 2013 (feet BTOC)	Groundwater Elevation (feet NGVD)
Bluff and Rainier Avenue Piezometers						
PZ-704	110.61	108.43	4.42*	106.19	4.53*	106.08
PZ-709	114.27	112.01	2.92*	111.35	2.89*	111.38
PZ-715	117.79	115.51	4.08*	113.71	4.34*	113.45
PZ-720	107.95	108.22	3.10	104.85	2.03	105.92
PZ-721	108.32	108.57	2.55	105.77	6.36	101.96
PZ-722	108.82	109.21	-0.93	109.75	-0.87	109.69
Other Neighborhood Piezometers						
PZ-719	107.13	107.37	2.06	105.07	7.39	99.74
PZ-723	106.45	106.80	2.41	104.04	6.81	99.64
PZ-724	106.56	106.88	1.06	105.50	6.72	99.84
PZ-725	108.31	108.58	2.25	106.06	2.64	105.67
PZ-726	105.39	105.61	2.82	102.57	6.98	98.41
PZ-728	105.33	105.84	2.29	103.04	6.68	98.65
RPZ-730	103.897	**	2.92	100.94	3.48	100.42
RPZ-731	105.085	**	3.72	101.33	4.42	100.66
RPZ-732	105.687	**	4.44	101.21	4.79	100.90

Notes:

BTOC = Below top of casing

[1]Elevations surveyed by White Shield for URS, January 5, 2000, Vertical Datum: NGVD 29

*Depth to water measurement was taken from an above ground surface top of casing. The associated groundwater elevation has been adjusted to account for the stickup.

**Ground surface not surveyed

NGVD = National Geodetic Vertical Datum 1929

Table 6A

Spring 2013 Discharge Volume and Analytical Results - Subdrain and Lagoon

2013 Annual Groundwater Monitoring Report
Palermo Wellfield Superfund Site
Tumwater, Washington

Location	Station Description	Volume (GPM) Units	Tetrachloroethene (µg/L)	Trichloroethene (µg/L)
Flow in Sub-Drain System				
Alternate 357	Cleanout CO-7	23	**7.5**	1.0 U
358	Cleanout CO-4	27	**10**	**16**
359	Cleanout CO-1	72	**6.5**	**13**
360	Tightline Pipe Outfall	201	**5.3**	**11**
Treatment Lagoon Inflows (Non-Sub-Drain)				
350	M Street Storm Drain Outfall	76	1.0 U*	**1.1**
356	Watercourse Upstream of Lagoon	NC	1.0 U*	1.0 U
362	M Street Terminus Catch Basin Outfall (rarely flows)	NF	NS	NS
Treatment Lagoon Effluent				
361	Lagoon Effluent	7,891	1.0 U*	**0.83 J**
Deschutes River Point of Compliance				
364	Deschutes River Outfall	13,336	1.0 U*	1.0 U
	Deschutes River Discharge Remediation Goal		0.8	2.7

Table 6B

Fall 2013 Discharge Volume and Analytical Results - Subdrain and Lagoon

2013 Annual Groundwater Monitoring Report
Palermo Wellfield Superfund Site
Tumwater, Washington

Location	Station Description	Volume (GPM) Units	Tetrachloroethene (µg/L)	Trichloroethene (µg/L)
Flow in Sub-Drain System				
357	Cleanout CO-6	6	**10**	**10**
358	Cleanout CO-4	16	**7.2**	**16**
359	Cleanout CO-1	172	**4.8**	**12**
360	Tightline Pipe Outfall	64	**4.3**	**11**
Treatment Lagoon Inflows (Non-Sub-Drain)				
350	M Street Storm Drain Outfall	19	0.50 U	**1.4**
356	Watercourse Upstream of Lagoon	NC	0.50 U	0.50 U
362	M Street Terminus Catch Basin Outfall (rarely flows)	NF	NS	NS
Treatment Lagoon Effluent				
361	Lagoon Effluent	1,306	0.50 U	**0.92**
Deschutes River Point of Compliance				
364	Deschutes River Outfall	8,883	0.50 U	**0.50**
	Deschutes River Discharge Remediation Goal		0.8	2.7

Notes:

GPM = gallons per minute
µg/L = microgram per liter
NG = no remediation goal
NS = not sampled
NF = no flow; not calculated
NC = not calculated because flow was too slow to measure
J = estimated concentration
U = parameter not detected above the reporting limit
Bold font type indicates analyte was detected
Exceeds remediation goal
*Quantitation limit above site remediation goal
Samples were also analyzed for 1,1-DCE, trans-1,2-DCE, cis-1,2-DCE and vinyl chloride but were not detected.
Samples were collected on March 8, and October 3, 2013.

Table 7

Sediment Accumulation in Catch Basins and Cleanouts in Subdrain System

2013 Annual Groundwater Monitoring Report
Palermo Wellfield Superfund Site
Tumwater, Washington

Location	Depth to Water (feet)	Water Elevation (feet, NGVD)	Original Total Depth (Feb. 2001) (feet)	Measured Total Depth (feet)	Net Change (feet)	Catch Basin and Subdrain Cleanout Observations
Spring 2013						
CB-1	5.06	N/A	7.78	7.95	-0.17	No debris, moderate flow, difficult to measure because catch basin neck not positioned over tightline pipe inlet to catch basin.
CB-2	6.59	N/A	8.78	8.8	-0.02	
CB-3	6.10	N/A	8.81	8.98	-0.17	
CO-1 (359)	5.87	102.52	7.82	7.82	0	Free of debris, moderate flow
CO-2	5.42	102.62	7.10	7.94	-0.84	Free of debris, visually flowing but too slow to measure, gray sheen on water in cleanout
CO-3	5.18	102.78	6.84	6.80	0.04	Free of debris, moderate flow
CO-4 (358)	5.90	102.83	7.84	7.21	0.63	Grasses/tree roots present in cleanout flowing from south to north, moderate to slow flow
CO-5	6.32	103.00	7.84	7.45	0.39	Tree roots present in cleanout flowing from south to north, moderate to slow flow
CO-6	NM	NM	7.7	NM	NM	Unable to access, could not gain property owner permission
CO-7 (Alt 357)	6.73	104.00	7.89	7.04	0.85	Free of debris, slow flow
CO-8	NM	NM	8.1	NM	NM	Unable to access because thick layer of mud covered lid, back yard contained hand dug trenches filled with stagnant water, water was conveyed along the south side of the house to disperse or to the north side of house to the storm drain.
Fall 2013						
CB-1	5.08	N/A	7.78	7.95	-0.17	Soft bottom, clear, no debris, allen wrench fell inside catch basin
CB-2	6.65	N/A	8.78	8.81	-0.03	Soft bottom, clear, no debris
CB-3	6.17	N/A	8.81	9.09	-0.28	Soft bottom, clear, no debris
CO-1 (359)	5.59	102.8	7.82	7.86	-0.04	Hard bottom, clear, no debris, submerged
CO-2	5.39	102.62	7.10	7.31	-0.21	Hard bottom, clear, no debris
CO-3	5.07	102.89	6.84	6.94	-0.1	Hard bottom, clear, no debris
CO-4 (358)	5.78	102.95	7.84	7.85	-0.01	Soft bottom, clear, low flow
CO-5	6.2	103.12	7.84	8.03	-0.19	Soft bottom, tree roots, bubbled when flow probe submerged
CO-6	6.54	103.24	7.7	7.55	0.15	Soft bottom, high flow, no debris
CO-7 (Alt 357)	6.76	103.97	7.89	7.55	0.15	Soft bottom, low flow, no debris
CO-8	6.51	104.45	8.1	8.03	0.07	Soft bottom, low flow, no debris

Notes:

Exceeds 0.5 foot accumulated sediment (Section 4.2.1 Trunk Drain, O&M Manual, URS 2002)

N/A = Not applicable

NM = Not measured

NGVD = National Geodetic Vertical Datum 1929

Table 8

Subdrain Performance

2013 Annual Groundwater Monitoring Report
Palermo Wellfield Superfund Site
Tumwater, Washington

Upgradient Station	Upgradient Ground Surface Elevation[1] (feet)	Upgradient Groundwater Elevation (feet)	Compliance Station	Compliance Ground Surface Elevation[1] (feet)	Compliance Groundwater Elevation (feet)	Depth to Water from Ground Surface (feet)[2]	3 Foot Elevation Reduction Met
Spring 2013							
PZ-704	108.43	106.19	PZ-720	108.22	104.85	3.37	Yes
PZ-709	112.01	111.35	PZ-721	108.57	105.77	2.80	No
PZ-715	115.51	113.71	PZ-722	109.21	109.75	-0.54	No
Fall 2013							
PZ-704	108.43	106.08	PZ-720	108.22	105.92	2.30	No
PZ-709	112.01	111.38	PZ-721	108.57	101.96	6.61	Yes
PZ-715	115.51	113.45	PZ-722	109.21	109.69	-0.48	No

Notes:

[1]Elevations in NGVD 29. Surveyed by White Shield for URS January 5, 2000

[2]Compliance ground surface minus compliance groundwater elevation

FIGURES

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Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
3. TW-3 and TW-16 are installed but not operating.

Data Source: Long term monitoring locations provided by Parametrix 2012
Imagery from ESRI 2013.
Projection: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Monitoring well and identifier
Piezometer and identifier
Groundwater seep and identifier
City production well and identifier
City test well and identifier
Stripper tower and identifier
Former city production well and identifier
Former monitoring well and identifier

N
W E
S

400 0 400
Feet

Site Plan

Palermo Wellfield Superfund Site

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Figure 1

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
3. TW-16 is installed but not operating. TW-5 is inactive.

Data Source: Long-term monitoring locations from Parametrix 2012.
Subdrain layout provided by URS 2000, Imagery from ESRI 2013.
Projection: NAD 1983 StatePlane Washington South FIPS 4602 Feet

- Monitoring well and identifier
- Piezometer and identifier
- Groundwater seep and identifier
- City production well and identifier
- City test well and identifier
- Stripper tower and identifier
- Former city production well and identifier
- Catch basin and identifier
- Subdrain cleanout sampling station and identifier
- Treatment lagoon sampling station and identifier
- Cleanout location and identifier
- Subdrain tightline pipe
- Subdrain perforated pipe

N W E S

120 0 120
Feet

Palermo Neighborhood and Subdrain

Palermo Wellfield Superfund Site

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Figure 2

P:\0\0180121\GIS\MXDs\GroundWater_Monitoring\Revised_2013_AnnualReport\018012107_F2_NeighborhoodSubdrain.mxd Date Exported: 03/09/17 by ccheif

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc.and will serve as the official record of this communication.
3. TW-16 is installed but not operating. TW-5 is inactive.
4. Groundwater elevations collected March 4, 2013.
5. Groundwater elevation estimated using Surfer (Golden Software) 8.0 contouring software using the Natural Neighbor gridding method.
6. Groundwater elevations are relative to NAVD88 datum.

Data Sources: Long-term monitoring locations provided by Parametrix 2012.
Imagery from ESRI 2013.
Projection: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Monitoring well and identifier
Piezometer and identifier
Groundwater seep and identifier
City production well and identifier
City test well and identifier
Stripper tower and identifier
Former city production well and identifier
Former monitoring well and identifier
100 Estimated groundwater elevation
NM Not Measured

N W E S

400 0 400
Feet

Spring 2013
Generalized Groundwater Elevations

Palermo Wellfield Superfund Site

GEOENGINEERS

Figure 3

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc.and will serve as the official record of this communication.
3. TW-16 is installed but not operating. TW-5 is inactive.
4. Groundwater elevations collected September 16, 2013.
5. Groundwater elevation estimated using Surfer (Golden Software) 8.0 contouring software using the Natural Neighbor gridding method.
6. Groundwater elevations are relative to NAVD88 datum.

Data Sources: Long-term monitoring locations provided by Parametrix 2012. Imagery from ESRI 2013.
Projection: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Monitoring well and identifier
Piezometer and identifier
Groundwater seep and identifier
City production well and identifier
City test well and identifier
Stripper tower and identifier
Former city production well and identifier
Former monitoring well and identifier
100 Estimated groundwater elevation
NM Not Measured

N W E S

400 0 400
Feet

Fall 2013
Generalized Groundwater Elevations

Palermo Wellfield Superfund Site

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Figure 4

P:\0\0180121\GIS\MXDs\GroundWater_Monitoring\Revised_2013_AnnualReport\0180121207_F4_FallGW_Elevation.mxd Date Exported: 03/09/17 by ccheif

Notes:
1. Concentrations presented in µg/L
2. The locations of all features shown are approximate.
3. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
4. TW-16 is installed but not operating. TW-5 is inactive.

Data Source: Long-term monitoring locations provided by Parametrix 2012.
Imagery from ESRI 2013.
Projection: NAD 1983 StatePlane Washington South FIPS 4602 Feet

- Monitoring well and identifier
- Piezometer and identifier
- Groundwater seep and identifier
- City production well and identifier
- City test well and identifier
- Stripper tower and identifier
- Former city production well and identifier
- Former monitoring well and identifier
- U Compound not detected at the reporting limit
- J Estimated concentration

N
W E
S

400 0 400
Feet

Spring 2013
PCE Concentrations in Groundwater (µg/L)

Palermo Wellfield Superfund Site

GEOENGINEERS

Figure 5

P:\0\0180121\GIS\MXDs\GroundWater_Monitoring\Revised_2013_AnnualReport\018012107_F5_SpringPCE.mxd Date Exported: 03/03/17 by maugust

Notes:

1. Concentrations presented in µg/L
2. The locations of all features shown are approximate.
3. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
4. TW-16 is installed but not operating. TW-5 is inactive.

Data Source: Long-term monitoring locations provided by Parametrix 2012.
Imagery from ESRI 2013.
Projection: NAD 1983 StatePlane Washington South FIPS 4602 Feet

- Monitoring well and identifier
- Piezometer and identifier
- Groundwater seep and identifier
- City production well and identifier
- City test well and identifier
- Stripper tower and identifier
- Former city production well and identifier
- Former monitoring well and identifier
- U Compound not detected at the reporting limit
- J Estimated concentration

N
W E
S

400 0 400
Feet

Spring 2013
TCE Concentrations in Groundwater (µg/L)

Palermo Wellfield Superfund Site

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Figure 6

P:\0\0180121\GIS\MXDs\GroundWater_Monitoring\Revised_2013_AnnualReport\018012107_F6_SpringTCE.mxd Date Exported: 03/03/17 by maugust

Notes:

1. Concentrations presented in µg/L
2. The locations of all features shown are approximate.
3. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
4. TW-16 is installed but not operating. TW-5 is inactive.
5. Groundwater samples collected from September 17 to October 2, 2013

Data Source: Long-term monitoring locations provided by Parametrix 2012.
Imagery from ESRI 2013.
Projection: NAD 1983 StatePlane Washington South FIPS 4602 Feet

- Monitoring well and identifier
- Piezometer and identifier
- Groundwater seep and identifier
- City production well and identifier
- City test well and identifier
- Stripper tower and identifier
- Former city production well and identifier
- Former monitoring well and identifier
- U Compound not detected at the reporting limit
- J Estimated concentration

N W E S

400 0 400

Feet

Fall 2013
PCE Concentrations in Groundwater (µg/L)

Palermo Wellfield Superfund Site

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Figure 7

P:\0\0180121\GIS\MXDs\GroundWater_Monitoring\Revised_2013_AnnualReport\018012107_F7_FallPCE.mxd Date Exported: 03/03/17 by maugust

Notes:
1. Concentrations presented in µg/L
2. The locations of all features shown are approximate.
3. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
4. TW-16 is installed but not operating. TW-5 is inactive.
5. Groundwater Samples were collected from September 17 to October, 2013.

Data Source: Long-term monitoring locations provided by Parametrix 2012. Imagery from ESRI 2013.
Projection: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Monitoring well and identifier
Piezometer and identifier
Groundwater seep and identifier
City production well and identifier
City test well and identifier
Stripper tower and identifier
Former city production well and identifier
Former monitoring well and identifier
U Compound not detected at the reporting limit
J Estimated concentration

N
W E
S

400 0 400
Feet

Fall 2013
TCE Concentrations in Groundwater (µg/L)

Palermo Wellfield Superfund Site

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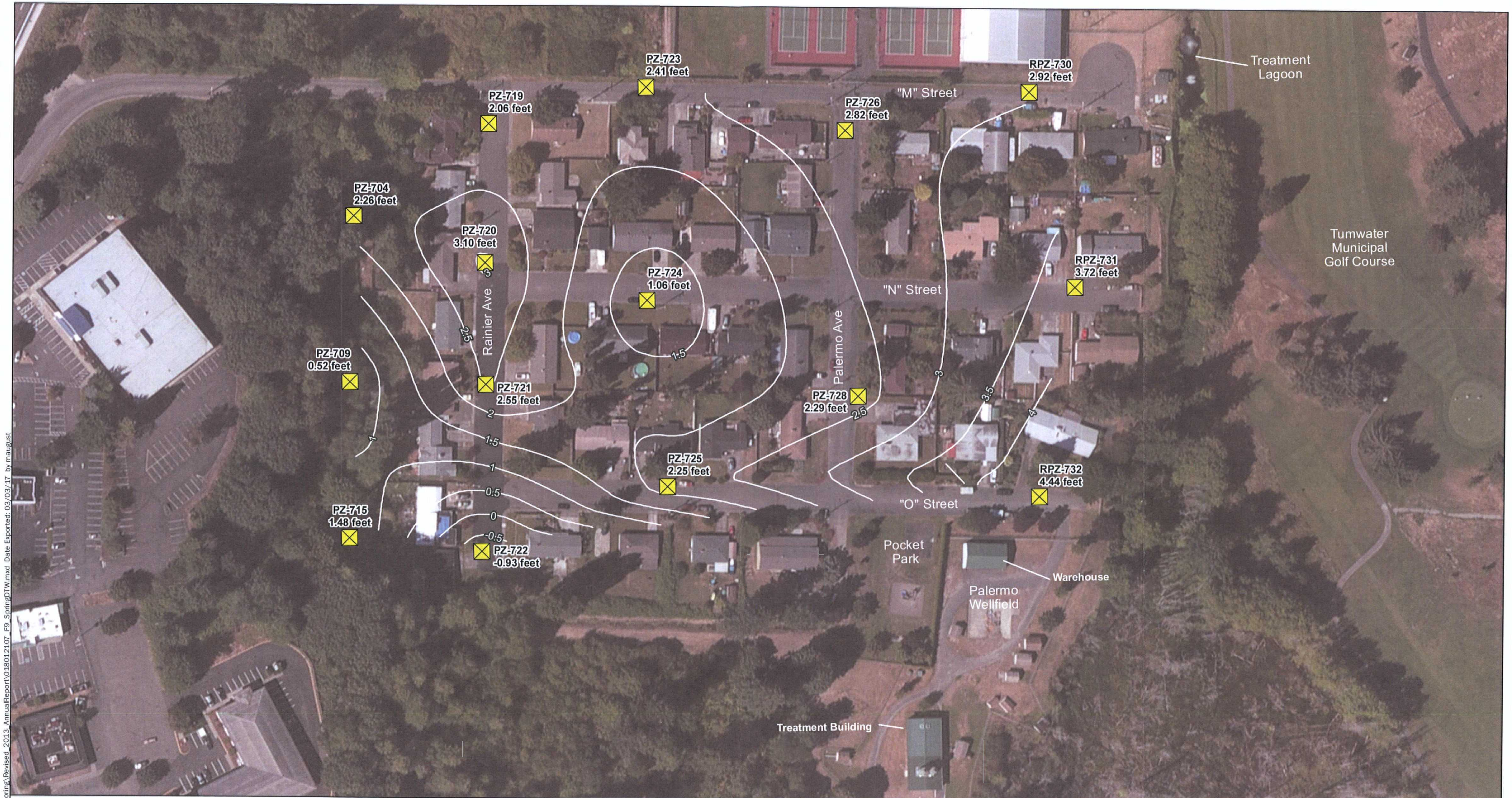
Figure 8

P:\0\0180121\GIS\MXDs\GroundWater_Monitoring\Revised_2013_AnnualReport\018012107_F8_FallTCE.mxd Date Exported: 03/03/17 by maugust



Notes:

1. Depth to water measurements were made on March 4, 2013.
2. The locations of all features shown are approximate.
3. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
4. Contours were generated using Surfer 8.0 (Golden Software) contouring software using the natural neighbor gridding method.
5. Depth to water measurements at RPZ-730, RPZ-731, and RPZ-732 are calculated from the tops-of-casings, which are slightly below the flush-mounted monument.

Data Source: Elevation Datum Reference: NAVD88.
Imagery From ESRI 2013
Projection: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Piezometer, identifier, and depth to groundwater

Estimated or inferred groundwater depth-to-water contours (piezometers)

N
W E
S

120 0 120
Feet

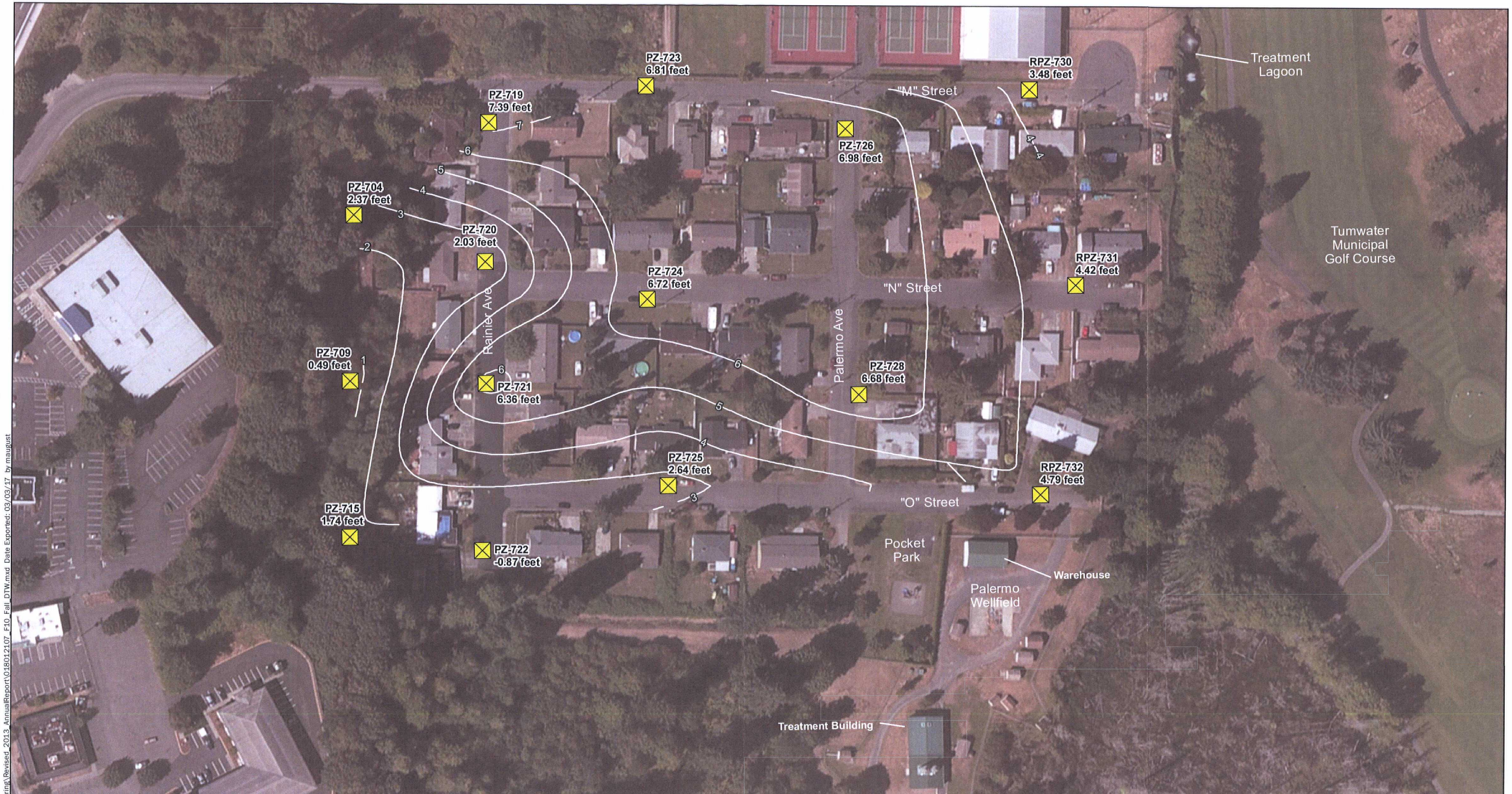
Spring 2013
Estimated Depth to Groundwater

Palermo Wellfield Superfund Site

GeoEngineers

Figure 9

P:\0\0180121\GIS\MXDs\GroundWater_Monitoring\Revised_2013_AnnualReport\018012107_F9_SpringDTW.mxd Date Exported: 03/03/17 by maugust



Notes:

1. Depth to water measurements were made on September 16, 2013.
2. The locations of all features shown are approximate.
3. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
4. Contours were generated using Surfer 8.0 (Golden Software) contouring software using the natural neighbor gridding method.
5. Depth to water measurements at RPZ-730, RPZ-731, and RPZ-732 are calculated from the tops-of-casings, which are slightly below the flush-mounted monument.

Data Source: Elevation Datum Reference: NAVD88.
Imagery From ESRI 2013
Projection: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Piezometer, identifier, and depth to groundwater

Estimated or inferred goundwater depth-to-water contours (piezometers)

NM Not Measured

N W E S

120 0 120
Feet

Fall 2013
Estimated Depth to Groundwater

Palermo Wellfield Superfund Site

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Figure 10

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Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
3. TW-16 is installed but not operating. TW-5 is inactive.
4. Subdrain and lagoon samples were collected on March 5 to 19 2013.

Data Source: Long-term monitoring locations from Parametrix 2012. Subdrain layout provided by URS 2000, Imagery from ESRI 2013.
Projection: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Monitoring well and identifier
Piezometer and identifier
Groundwater seep and identifier
City production well and identifier
City test well and identifier
Stripper tower and identifier
Former city production well and identifier
Catch basin and identifier
Subdrain cleanout sampling station and identifier
Treatment lagoon sampling station and identifier
Cleanout location and identifier
U Compound not detected at the reporting limit
J Estimated concentration
NC Not calculated
Subdrain tightline pipe
Subdrain perforated pipe

120 0 120
Feet

N E S W

Spring 2013 - Subdrain and Treatment Lagoon Monitoring Results Palermo Neighborhood

Palermo Wellfield Superfund Site

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Figure 11

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
3. TW-16 is installed but not operating. TW-5 is inactive.
4. Subdrain and lagoon samples were collected on October 3, 2013.

Data Source: Long-term monitoring locations from Parametrix 2012. Subdrain layout provided by URS 2000, Imagery from ESRI 2013.
Projection: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Monitoring well and identifier
Piezometer and identifier
Groundwater seep and identifier
City production well and identifier
City test well and identifier
Stripper tower and identifier
Former city production well and identifier
Catch basin and identifier
Subdrain cleanout sampling station and identifier
Treatment lagoon sampling station and identifier
Cleanout location and identifier
U Compound not detected at the reporting limit
J Estimated concentration
NC Not calculated
Subdrain tightline pipe
Subdrain perforated pipe

N W E S

120 0 120
Feet

Fall 2013 - Subdrain and Treatment Lagoon Monitoring Results Palermo Neighborhood

Palermo Wellfield Superfund Site

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Figure 12

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APPENDICES

GeoEngineers

APPENDIX A
Field Forms
(Included on CD)

APPENDIX B
Analytical Data Summary Tables

Table B-1

Groundwater Results

Spring 2013 Groundwater Monitoring Report
Palermo Wellfield Superfund Site
Tumwater, Washington

Location	Sample ID	Date	Type	1,1,1,2-Tetrachloroethane (µg/L)	1,1,1-Trichloroethane (µg/L)	1,1,2,2-Tetrachloroethane (µg/L)	1,1,2-Trichloro-1,2,2-trifluoroethane (CFC-113) (µg/L)	1,1,2-Trichloroethane (µg/L)	1,1-Dichloroethane (µg/L)	1,1-Dichloroethene (µg/L)	1,1-Dichloropropene (µg/L)	1,2,3-Trichlorobenzene (µg/L)	1,2,3-Trichloropropane (µg/L)	1,2,4-Trichlorobenzene (µg/L)	1,2,4-Trimethylbenzene (µg/L)	1,2-Dibromo-3-Chloropropane (µg/L)	1,2-dibromoethane (EDB) (µg/L)	1,2-Dichlorobenzene (o-Dichlorobenzene) (µg/L)	1,2-Dichloroethane (EDC) (µg/L)	1,2-Dichloropropane (µg/L)	1,3,5-Trimethylbenzene (µg/L)	1,3-Dichlorobenzene (m-Dichlorobenzene) (µg/L)	1,3-Dichloropropane (µg/L)	1,4-Dichlorobenzene (p-Dichlorobenzene) (µg/L)	2,2-Dichloropropane (µg/L)	2-Butanone (MEK) (µg/L)	2-Chloroethyl vinyl ether (µg/L)	2-Chlorotoluene (µg/L)
MW-100	MW-100 130305	03/05/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
MW-101A	MW-101A 130306	03/06/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
MW-101B	MW-101B 130305 26.5 FT	03/05/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
MW-102	MW-102 130305 20 FT	03/05/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
MW-103	MW-103 130306	03/06/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
MW-104A	MW-104A 130307	03/07/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
MW-104B	MW-104B 130311	03/11/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
MW-107	MW-107 130306	03/06/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
MW-109	MW-109 130305	03/05/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
MW-110	DUP-1 130306	03/06/2013	Duplicate	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
MW-110	MW-110 130306	03/06/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
MW-111	MW-111 130307	03/07/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
MW-4A	MW-4A 130312	03/12/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
MW-4B	MW-4B 130312	03/12/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
MW-93-02	MW-93-02 130312	03/12/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
MW-96-15	MW-96-15 130307	03/07/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 R	1.0 U
MW-96-16	MW-96-16 130306	03/06/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
MW-96-17	MW-96-17 130306	03/06/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
MW-ES-02	MW-ES-02 130307	03/07/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
MW-ES-03	DUP-2_130307	03/07/2013	Duplicate	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
MW-ES-03	MW-ES-03 130307	03/07/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
MW-ES-04	MW-ES-04 130308	03/08/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
MW-ES-05	MW-ES-05 130308	03/08/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
MW-ES-06	MW-ES-06 130308	03/08/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
MW-ES-07	MW-ES-07 130305 30 FT	03/05/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 R	1.0 U
MW-ES-08	MW-ES-08 130305	03/05/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
MW-ES-09	MW-ES-09 130311	03/11/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
MW-ES-10	MW-ES-10 130311	03/11/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
MW-ES-11	MW-ES-11 130306	03/06/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
MW-UI	MW-UI 130305	03/05/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
PZ-704	PZ-704 130313	03/13/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
PZ-709	PZ-709 130313	03/13/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.38 J	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
PZ-715	PZ-715 130313	03/13/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.65 J	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U

Location	Sample ID	Date	Type	1,1,1,2-Tetrachloroethane (µg/L)	1,1,1-Trichloroethane (µg/L)	1,1,2,2-Tetrachloroethane (µg/L)	1,1,2-Trichloro-1,2,2-trifluoroethane (CFC-113) (µg/L)	1,1,2-Trichloroethane (µg/L)	1,1-Dichloroethane (µg/L)	1,1-Dichloroethene (µg/L)	1,1-Dichloropropene (µg/L)	1,2,3-Trichlorobenzene (µg/L)	1,2,3-Trichloropropane (µg/L)	1,2,4-Trichlorobenzene (µg/L)	1,2,4-Trimethylbenzene (µg/L)	1,2-Dibromo-3-Chloropropane (µg/L)	1,2-dibromoethane (EDB) (µg/L)	1,2-Dichlorobenzene (o-Dichlorobenzene) (µg/L)	1,2-Dichloroethane (EDC) (µg/L)	1,2-Dichloropropane (µg/L)	1,3,5-Trimethylbenzene (µg/L)	1,3-Dichlorobenzene (m-Dichlorobenzene) (µg/L)	1,3-Dichloropropane (µg/L)	1,4-Dichlorobenzene (p-Dichlorobenzene) (µg/L)	2,2-Dichloropropane (µg/L)	2-Butanone (MEK) (µg/L)	2-Chloroethyl vinyl ether (µg/L)	2-Chlorotoluene (µg/L)
PZ-719	DUP-4 130314	03/14/2013	Duplicate	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
PZ-719	PZ-719 130314	03/14/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
PZ-720	PZ-720 130314	03/14/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
PZ-721	PZ-721 130314	03/14/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
PZ-722	PZ-722 130314	03/14/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
PZ-723	PZ-723 130314	03/14/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
PZ-724	PZ-724 130314	03/14/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
PZ-725	PZ-725 130314	03/14/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
PZ-726	PZ-726 130312	03/12/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
PZ-728	PZ-728 130307	03/07/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
RPZ-730	RPZ-730 130313	03/13/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
RPZ-731	RPZ-731 130313	03/13/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
RPZ-732	RPZ-732 130312	03/12/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
WDOT-MW-1	WDOT-MW-1 130307	03/07/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U
WDOT-MW-2	WDOT-MW-2 130306	03/06/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U

Location	Sample ID	Date	Type	4-Chlorotoluene (µg/L)	4-Methyl-2-Pentanone (Methyl isobutyl ketone) (µg/L)	Acetone (µg/L)	Acrolein (µg/L)	Acrylonitrile (µg/L)	Benzene (µg/L)	Benzene, 1,2,3-Trimethyl- (µg/L)	Bromobenzene (µg/L)	Bromodichloromethane (µg/L)	Bromoform (Tribromomethane) (µg/L)	Bromomethane (µg/L)	Carbon Tetrachloride (µg/L)	Chlorobenzene (µg/L)	Chloroethane (µg/L)	Chloroform (µg/L)	Chloromethane (µg/L)	cis-1,2-Dichloroethene (µg/L)	Cis-1,3-Dichloropropene (µg/L)	Dibromochloromethane (µg/L)	Dibromomethane (µg/L)	Dichlorodifluoromethane (CFC-12) (µg/L)	Diisopropyl Ether (Dot) (µg/L)	Ethylbenzene (µg/L)	Hexachlorobutadiene (µg/L)
MW-100	MW-100 130305	03/05/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
MW-101A	MW-101A 130306	03/06/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
MW-101B	MW-101B 130305 26.5 FT	03/05/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
MW-102	MW-102 130305 20 FT	03/05/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
MW-103	MW-103 130306	03/06/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
MW-104A	MW-104A 130307	03/07/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
MW-104B	MW-104B 130311	03/11/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
MW-107	MW-107 130306	03/06/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
MW-109	MW-109 130305	03/05/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
MW-110	DUP-1 130306	03/06/2013	Duplicate	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
MW-110	MW-110 130306	03/06/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
MW-111	MW-111 130307	03/07/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
MW-4A	MW-4A 130312	03/12/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
MW-4B	MW-4B 130312	03/12/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
MW-93-02	MW-93-02 130312	03/12/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
MW-96-15	MW-96-15 130307	03/07/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
MW-96-16	MW-96-16 130306	03/06/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
MW-96-17	MW-96-17 130306	03/06/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
MW-ES-02	MW-ES-02 130307	03/07/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
MW-ES-03	DUP-2_130307	03/07/2013	Duplicate	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
MW-ES-03	MW-ES-03 130307	03/07/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
MW-ES-04	MW-ES-04 130308	03/08/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
MW-ES-05	MW-ES-05 130308	03/08/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
MW-ES-06	MW-ES-06 130308	03/08/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
MW-ES-07	MW-ES-07 130305 30 FT	03/05/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
MW-ES-08	MW-ES-08 130305	03/05/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
MW-ES-09	MW-ES-09 130311	03/11/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
MW-ES-10	MW-ES-10 130311	03/11/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
MW-ES-11	MW-ES-11 130306	03/06/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
MW-UI	MW-UI 130305	03/05/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	**0.34 J**	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
PZ-704	PZ-704 130313	03/13/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
PZ-709	PZ-709 130313	03/13/2013	Primary	1.0 U	10 U	11 UJ	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
PZ-715	PZ-715 130313	03/13/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U

Location	Sample ID	Date	Type	4-Chlorotoluene	4-Methyl-2-Pentanone (Methyl isobutyl ketone)	Acetone	Acrolein	Acrylonitrile	Benzene	Benzene, 1,2,3-Trimethyl-	Bromobenzene	Bromodichloromethane	Bromoform (Tribromomethane)	Bromomethane	Carbon Tetrachloride	Chlorobenzene	Chloroethane	Chloroform	Chloromethane	cis-1,2-Dichloroethene	Cis-1,3-Dichloropropene	Dibromochloromethane	Dibromomethane	Dichlorodifluoromethane (CFC-12)	Diisopropyl Ether (Dot)	Ethylbenzene	Hexachlorobutadiene
				(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
PZ-719	DUP-4 130314	03/14/2013	Duplicate	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
PZ-719	PZ-719 130314	03/14/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
PZ-720	PZ-720 130314	03/14/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
PZ-721	PZ-721 130314	03/14/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
PZ-722	PZ-722 130314	03/14/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
PZ-723	PZ-723 130314	03/14/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
PZ-724	PZ-724 130314	03/14/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.2	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
PZ-725	PZ-725 130314	03/14/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
PZ-726	PZ-726 130312	03/12/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
PZ-728	PZ-728 130307	03/07/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	0.31 J	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	0.39 J	1.0 U
RPZ-730	RPZ-730 130313	03/13/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
RPZ-731	RPZ-731 130313	03/13/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
RPZ-732	RPZ-732 130312	03/12/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
WDOT-MW-1	WDOT-MW-1 130307	03/07/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U
WDOT-MW-2	WDOT-MW-2 130306	03/06/2013	Primary	1.0 U	10 U	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U

Location	Sample ID	Date	Type	Isopropylbenzene (Cumene) (µg/L)	Methyl t-butyl ether (µg/L)	Methylene Chloride (µg/L)	Naphthalene (µg/L)	n-Butylbenzene (µg/L)	n-Propylbenzene (µg/L)	p-Isopropyltoluene (µg/L)	Sec-Butylbenzene (µg/L)	Styrene (µg/L)	Tert-Butylbenzene (µg/L)	Tetrachloroethene (µg/L)	Toluene (µg/L)	Total Xylenes (µg/L)	Trans-1,2-Dichloroethene (µg/L)	Trans-1,3-Dichloropropene (µg/L)	Trichloroethene (TCE) (µg/L)	Trichlorofluoromethane (CFC-11) (µg/L)	Vinyl Chloride (µg/L)
MW-100	MW-100 130305	03/05/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U
MW-101A	MW-101A 130306	03/06/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U
MW-101B	MW-101B 130305 26.5 FT	03/05/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U
MW-102	MW-102 130305 20 FT	03/05/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	**3.0**	5.0 U	1.0 U
MW-103	MW-103 130306	03/06/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U
MW-104A	MW-104A 130307	03/07/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	**8.0**	5.0 U	1.0 U
MW-104B	MW-104B 130311	03/11/2013	Primary	1.0 U	1.0 U	1.7 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**1.4**	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U
MW-107	MW-107 130306	03/06/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U
MW-109	MW-109 130305	03/05/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	**15**	5.0 U	1.0 U
MW-110	DUP-1 130306	03/06/2013	Duplicate	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U
MW-110	MW-110 130306	03/06/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U
MW-111	MW-111 130307	03/07/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	**9.1**	5.0 U	1.0 U
MW-4A	MW-4A 130312	03/12/2013	Primary	1.0 U	1.0 U	1.7 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U
MW-4B	MW-4B 130312	03/12/2013	Primary	1.0 U	1.0 U	1.6 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U
MW-93-02	MW-93-02 130312	03/12/2013	Primary	1.0 U	1.0 U	1.6 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U
MW-96-15	MW-96-15 130307	03/07/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U
MW-96-16	MW-96-16 130306	03/06/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U
MW-96-17	MW-96-17 130306	03/06/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U
MW-ES-02	MW-ES-02 130307	03/07/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	**38**	5.0 U	1.0 U
MW-ES-03	DUP-2_130307	03/07/2013	Duplicate	1.0 U	1.0 U	5.0 U	**1.8 J**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	**20**	5.0 U	1.0 U
MW-ES-03	MW-ES-03 130307	03/07/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	**17**	5.0 U	1.0 U
MW-ES-04	MW-ES-04 130308	03/08/2013	Primary	1.0 U	1.0 U	5.0 U	**1.8 J**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**44**	5.0 U	3.0 U	1.0 U	1.0 U	**0.56 J**	5.0 U	1.0 U
MW-ES-05	MW-ES-05 130308	03/08/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	**27**	5.0 U	1.0 U
MW-ES-06	MW-ES-06 130308	03/08/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**23**	5.0 U	3.0 U	1.0 U	1.0 U	**0.97 J**	5.0 U	1.0 U
MW-ES-07	MW-ES-07 130305 30 FT	03/05/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	**3.9**	5.0 U	1.0 U
MW-ES-08	MW-ES-08 130305	03/05/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U
MW-ES-09	MW-ES-09 130311	03/11/2013	Primary	1.0 U	1.0 U	1.7 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	**120**	5.0 U	1.0 U
MW-ES-10	MW-ES-10 130311	03/11/2013	Primary	1.0 U	1.0 U	1.7 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	**37**	5.0 U	1.0 U
MW-ES-11	MW-ES-11 130306	03/06/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U
MW-UI	MW-UI 130305	03/05/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	**8.1**	5.0 U	1.0 U
PZ-704	PZ-704 130313	03/13/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U
PZ-709	PZ-709 130313	03/13/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U
PZ-715	PZ-715 130313	03/13/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U

Location	Sample ID	Date	Type	Isopropylbenzene (Cumene) (µg/L)	Methyl t-butyl ether (µg/L)	Methylene Chloride (µg/L)	Naphthalene (µg/L)	n-Butylbenzene (µg/L)	n-Propylbenzene (µg/L)	p-Isopropyltoluene (µg/L)	Sec-Butylbenzene (µg/L)	Styrene (µg/L)	Tert-Butylbenzene (µg/L)	Tetrachloroethene (µg/L)	Toluene (µg/L)	Total Xylenes (µg/L)	Trans-1,2-Dichloroethene (µg/L)	Trans-1,3-Dichloropropene (µg/L)	Trichloroethene (TCE) (µg/L)	Trichlorofluoromethane (CFC-11) (µg/L)	Vinyl Chloride (µg/L)
PZ-719	DUP-4 130314	03/14/2013	Duplicate	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	**1.5**	5.0 U	1.0 U
PZ-719	PZ-719 130314	03/14/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	**1.6**	5.0 U	1.0 U
PZ-720	PZ-720 130314	03/14/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**0.38 J**	5.0 U	3.0 U	1.0 U	1.0 U	**5.0**	5.0 U	1.0 U
PZ-721	PZ-721 130314	03/14/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	**30**	5.0 U	1.0 U
PZ-722	PZ-722 130314	03/14/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U
PZ-723	PZ-723 130314	03/14/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U
PZ-724	PZ-724 130314	03/14/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	**32**	5.0 U	1.0 U
PZ-725	PZ-725 130314	03/14/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U
PZ-726	PZ-726 130312	03/12/2013	Primary	1.0 U	1.0 U	1.6 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	**2.7**	5.0 U	1.0 U
PZ-728	PZ-728 130307	03/07/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**4 J**	3.0 U	1.0 U	1.0 U	**4.7**	5.0 U	1.0 U
RPZ-730	RPZ-730 130313	03/13/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U
RPZ-731	RPZ-731 130313	03/13/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	**0.60 J**	5.0 U	1.0 U
RPZ-732	RPZ-732 130312	03/12/2013	Primary	1.0 U	1.0 U	1.7 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U
WDOT-MW-1	WDOT-MW-1 130307	03/07/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U
WDOT-MW-2	WDOT-MW-2 130306	03/06/2013	Primary	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U

Notes:

µg/L = micrograms per liter

U = not detected at or above the reported detection limit

R = rejected result

J = estimated result detected below the reporting detection limit and above the method detection limit

UJ = not detected at or above the listed detection limit; the limit is an approximate value

Bold = detected result above the method detection limit.

Table B-2

Subdrain Results

Spring 2013 Groundwater Monitoring Report
Palermo Wellfield Superfund Site
Tumwater, Washington

Location	Sample ID	Date	Type	1,1,1,2-Tetrachloroethane (µg/L)	1,1,1-Trichloroethane (µg/L)	1,1,2,2-Tetrachloroethane (µg/L)	1,1,2-Trichloro-1,2,2-trifluoroethane (CFC-113) (µg/L)	1,1,2-Trichloroethane (µg/L)	1,1-Dichloroethane (µg/L)	1,1-Dichloroethene (µg/L)	1,1-Dichloropropene (µg/L)	1,2,3-Trichlorobenzene (µg/L)	1,2,3-Trichloropropane (µg/L)	1,2,4-Trichlorobenzene (µg/L)	1,2,4-Trimethylbenzene (µg/L)	1,2-Dibromo-3-Chloropropane (µg/L)	1,2-dibromoethane (EDB) (µg/L)	1,2-Dichlorobenzene (o-Dichlorobenzene) (µg/L)	1,2-Dichloroethane (EDC) (µg/L)	1,2-Dichloropropane (µg/L)	1,3,5-Trimethylbenzene (µg/L)	1,3-Dichlorobenzene (m-Dichlorobenzene) (µg/L)	1,3-Dichloropropane (µg/L)	1,4-Dichlorobenzene (p-Dichlorobenzene) (µg/L)	2,2-Dichloropropane (µg/L)	2-Butanone (MEK) (µg/L)	2-Chloroethyl vinyl ether (µg/L)	2-Chlorotoluene (µg/L)	4-Chlorotoluene (µg/L)	4-Methyl-2-Pentanone (Methyl isobutyl ketone) (µg/L)
Sub-Drain System																														
357	357 130308	03/08/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U	1.0 U	10 U
357	DUP-3 130308	03/08/2013	Duplicate	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U	1.0 U	10 U
358	358 130308	03/08/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U	1.0 U	10 U
359	359 130308	03/08/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U	1.0 U	10 U
360	360 130308	03/08/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U	1.0 U	10 U
350	350 130308	03/08/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U	1.0 U	10 U
356	356 130308	03/08/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U	1.0 U	10 U
361	361 130308	03/08/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U	1.0 U	10 U
364	364 130308	03/08/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 R	1.0 U	1.0 U	10 U
Seeps																														
Seep 1	SEEP-1 130319	03/19/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 UJ	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U	1.0 U	10 U
Seep 2	SEEP-2 130319	03/19/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 UJ	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U	1.0 U	10 U
Seep 3	SEEP-3 130319	03/19/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 UJ	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U	1.0 U	10 U
Seep 5	DUP-5 130319	03/19/2013	Duplicate	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 UJ	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U	1.0 U	10 U
Seep 5	SEEP-5 130319	03/19/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 UJ	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U	1.0 U	10 U
Wellfield Samples																														
ST-2	ST-2 130307	03/07/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U	1.0 U	10 U
TW-4	TW-4 130307	03/07/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U	1.0 U	10 U
TW-5	TW-5 130307	03/07/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U	1.0 U	10 U
TW-8	TW-8 130307	03/07/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.5 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	50 U	1.0 U	1.0 U	10 U

Location	Sample ID	Date	Type	Acetone (µg/L)	Acrolein (µg/L)	Acrylonitrile (µg/L)	Benzene (µg/L)	Benzene, 1,2,3-Trimethyl- (µg/L)	Bromobenzene (µg/L)	Bromodichloromethane (µg/L)	Bromoform (Tribromomethane) (µg/L)	Bromomethane (µg/L)	Carbon Tetrachloride (µg/L)	Chlorobenzene (µg/L)	Chloroethane (µg/L)	Chloroform (µg/L)	Chloromethane (µg/L)	cis-1,2-Dichloroethene (µg/L)	Cis-1,3-Dichloropropene (µg/L)	Dibromochloromethane (µg/L)	Dibromomethane (µg/L)	Dichlorodifluoromethane (CFC-12) (µg/L)	Diisopropyl Ether (Dot) (µg/L)	Ethylbenzene (µg/L)	Hexachlorobutadiene (µg/L)	Isopropylbenzene (Cumene) (µg/L)	Methyl t-butyl ether (µg/L)	Methylene Chloride (µg/L)	Naphthalene (µg/L)	n-Butylbenzene (µg/L)
Sub-Drain System																														
357	357 130308	03/08/2013	Primary	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U
357	DUP-3 130308	03/08/2013	Duplicate	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U
358	358 130308	03/08/2013	Primary	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U
359	359 130308	03/08/2013	Primary	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U
360	360 130308	03/08/2013	Primary	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U
350	350 130308	03/08/2013	Primary	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U
356	356 130308	03/08/2013	Primary	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U
361	361 130308	03/08/2013	Primary	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U
364	364 130308	03/08/2013	Primary	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U
Seeps																														
Seep 1	SEEP-1 130319	03/19/2013	Primary	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U
Seep 2	SEEP-2 130319	03/19/2013	Primary	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U
Seep 3	SEEP-3 130319	03/19/2013	Primary	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U
Seep 5	DUP-5 130319	03/19/2013	Duplicate	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U
Seep 5	SEEP-5 130319	03/19/2013	Primary	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U
Wellfield Samples																														
ST-2	ST-2 130307	03/07/2013	Primary	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U
TW-4	TW-4 130307	03/07/2013	Primary	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U
TW-5	TW-5 130307	03/07/2013	Primary	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U
TW-8	TW-8 130307	03/07/2013	Primary	50 U	50 U	10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	5.0 U	5.0 U	2.5 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U

Location	Sample ID	Date	Type	n-Propylbenzene	p-Isopropyltoluene	Sec-Butylbenzene	Styrene	Tert-Butylbenzene	Tetrachloroethene	Toluene	Total Xylenes	Trans-1,2-Dichloroethene	Trans-1,3-Dichloropropene	Trichloroethene (TCE)	Trichlorofluoromethane (CFC-11)	Vinyl Chloride
				(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Sub-Drain System																
357	357 130308	03/08/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**7.5**	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U
357	DUP-3 130308	03/08/2013	Duplicate	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**7.3**	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U
358	358 130308	03/08/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**10**	5.0 U	3.0 U	1.0 U	1.0 U	**16**	5.0 U	1.0 U
359	359 130308	03/08/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**6.5**	5.0 U	3.0 U	1.0 U	1.0 U	**13**	5.0 U	1.0 U
360	360 130308	03/08/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**5.3**	5.0 U	3.0 U	1.0 U	1.0 U	**11**	5.0 U	1.0 U
350	350 130308	03/08/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	**1.1**	5.0 U	1.0 U
356	356 130308	03/08/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U
361	361 130308	03/08/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	**0.83 J**	5.0 U	1.0 U
364	364 130308	03/08/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U
Seeps																
Seep 1	SEEP-1 130319	03/19/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U
Seep 2	SEEP-2 130319	03/19/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U
Seep 3	SEEP-3 130319	03/19/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**15**	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U
Seep 5	DUP-5 130319	03/19/2013	Duplicate	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U
Seep 5	SEEP-5 130319	03/19/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U
Wellfield Samples																
ST-2	ST-2 130307	03/07/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U
TW-4	TW-4 130307	03/07/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	**1.7**	5.0 U	1.0 U
TW-5	TW-5 130307	03/07/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U
TW-8	TW-8 130307	03/07/2013	Primary	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	3.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U

Notes:

µg/L = micrograms per liter

U = not detected at or above the reported detection limit

R = rejected result

J = estimated result detected below the reporting detection limit and above the method detection limit

UJ = not detected at or above the listed detection limit; the limit is an approximate value

Bold = detected result above the method detection limit.

Table B-3

Groundwater Results

Fall 2013 Groundwater Monitoring Report
Palermo Wellfield Superfund Site
Tumwater, Washington

Location	Sample ID	Date	Type	1,1,1,2-Tetrachloroethane (µg/L)	1,1,1-Trichloroethane (µg/L)	1,1,2,2-Tetrachloroethane (µg/L)	1,1,2-Trichloroethane (µg/L)	1,1-Dichloroethane (µg/L)	1,1-Dichloroethene (µg/L)	1,1-Dichloropropene (µg/L)	1,2,3-Trichlorobenzene (µg/L)	1,2,3-Trichloropropane (µg/L)	1,2,4-Trichlorobenzene (µg/L)	1,2,4-Trimethylbenzene (µg/L)	1,2-Dibromo-3-Chloropropane (µg/L)	1,2-dibromoethane (µg/L)	1,2-Dichlorobenzene (o-Dichlorobenzene) (µg/L)	1,2-Dichloroethane (µg/L)	1,2-Dichloropropane (µg/L)	1,3,5-Trimethylbenzene (µg/L)	1,3-Dichlorobenzene (m-Dichlorobenzene) (µg/L)	1,3-Dichloropropane (µg/L)	1,4-Dichlorobenzene (p-Dichlorobenzene) (µg/L)	2,2-Dichloropropane (µg/L)
MW-100	MW-100-130919	9/19/2013	Primary						0.50 U															
MW-101A	MW-101A-130917	9/17/2013	Primary						0.50 U															
MW-101B	MW-101B-130917	9/17/2013	Primary						0.50 U															
MW-102	MW-102-130917	9/17/2013	Primary						0.50 U															
MW-103	MW-103-130918	9/18/2013	Primary						0.50 U															
MW-104A	MW-104A-130927	9/27/2013	Primary						0.50 U															
MW-104B	MW-104B-130927	9/27/2013	Primary						0.50 U															
MW-107	MW-107-130920	9/20/2013	Primary						0.50 U															
MW-109	MW-109-130918	9/18/2013	Primary						0.50 U															
MW-110	MW-110-130920	9/20/2013	Primary						0.50 U															
MW-111	MW-111-130919	9/19/2013	Primary						0.50 U															
MW-4A	MW-4A-130926	9/26/2013	Primary						0.50 U															
MW-4B	DUP-5-130926	9/26/2013	Duplicate						0.50 U															
MW-4B	MW-4B-130926	9/26/2013	Primary						0.50 U															
MW-93-02	MW-93-02-130920	9/20/2013	Primary						0.50 U															
MW-96-15	MW-96-15-130917	9/17/2013	Primary						0.50 U															
MW-96-16	MW-96-16-130918	9/18/2013	Primary						0.50 U															
MW-96-17	MW-96-17-130918	9/18/2013	Primary						0.50 U															
MW-ES-02	MW-ES-02-130920	9/20/2013	Primary						0.50 U															
MW-ES-03	MW-ES-03-130919	9/19/2013	Primary						0.50 U															
MW-ES-04	MW-ES-04-130919	9/19/2013	Primary						0.50 U															
MW-ES-05	DUP-2-130920	9/20/2013	Duplicate						0.50 U															
MW-ES-05	MW-ES-05-130920	9/20/2013	Primary						0.50 U															
MW-ES-06	MW-ES-06-130920	9/20/2013	Primary						0.50 U															
MW-ES-07	MW-ES-07-130917	9/17/2013	Primary						0.50 U															
MW-ES-08	MW-ES-08-130919	9/19/2013	Primary						0.50 U															
MW-ES-09	MW-ES-09-130926	9/26/2013	Primary						1.0 U															
MW-ES-10	MW-ES-10-130926	9/26/2013	Primary						0.50 U															
MW-ES-11	DUP-1-130917	9/17/2013	Duplicate						0.50 U															
MW-ES-11	MW-ES-11-130917	9/17/2013	Primary						0.50 U															
MW-UI	MW-UI-130919	9/19/2013	Primary						0.50 U															
PZ-704	PZ-704-130923	9/23/2013	Primary						0.50 UJ															
PZ-709	PZ-709-130923	9/23/2013	Primary	0.20 UJ	0.20 UJ	0.20 UJ	0.20 UJ	0.20 UJ	0.20 UJ	0.20 UJ	0.20 UJ	0.20 UJ	0.20 UJ	0.20 UJ	1.0 UJ	0.20 UJ	0.20 UJ	0.20 UJ	0.20 UJ	0.20 UJ	0.20 UJ	0.20 UJ	0.20 UJ	0.20 UJ
PZ-715	PZ-715-130923	9/23/2013	Primary						0.50 UJ															

				1,1,1,2-Tetrachloroethane	1,1,1-Trichloroethane	1,1,2,2-Tetrachloroethane	1,1,2-Trichloroethane	1,1-Dichloroethane	1,1-Dichloroethene	1,1-Dichloropropene	1,2,3-Trichlorobenzene	1,2,3-Trichloropropane	1,2,4-Trichlorobenzene	1,2,4-Trimethylbenzene	1,2-Dibromo-3-Chloropropane	1,2-dibromoethane	1,2-Dichlorobenzene (o-Dichlorobenzene)	1,2-Dichloroethane	1,2-Dichloropropane	1,3,5-Trimethylbenzene	1,3-Dichlorobenzene (m-Dichlorobenzene)	1,3-Dichloropropane	1,4-Dichlorobenzene (p-Dichlorobenzene)	2,2-Dichloropropane
Location	Sample ID	Date	Type	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
PZ-719	PZ-719-130924	9/24/2013	Primary						0.50 U															
PZ-720	PZ-720-130924	9/24/2013	Primary						0.50 U															
PZ-721	DUP-4-130924	9/24/2013	Duplicate						0.50 U															
PZ-721	PZ-721-130924	9/24/2013	Primary						0.50 U															
PZ-722	PZ-722-130925	9/25/2013	Primary						0.50 U															
PZ-723	PZ-723-130925	9/25/2013	Primary						0.50 U															
PZ-724	PZ-724-130925	9/25/2013	Primary						0.50 U															
PZ-725	PZ-725-130924	9/24/2013	Primary						0.50 U															
PZ-726	PZ-726-130925	9/25/2013	Primary						0.50 U															
PZ-728	PZ-728-130925	9/25/2013	Primary						0.50 U															
RPZ-730	RPZ-730-130924	9/24/2013	Primary						0.50 U															
RPZ-731	RPZ-731-130924	9/24/2013	Primary						0.50 U															
RPZ-732	RPZ-732-130924	9/24/2013	Primary						0.50 U															
WDOT-MW-1	WSDOT-MW-1-130918	9/18/2013	Primary						0.50 U															
WDOT-MW-2	WSDOT-MW-2-130918	9/18/2013	Primary						0.50 U															

Location	Sample ID	Date	Type	2-Butanone (MEK)	2-Chloroethyl vinyl ether	2-Chlorotoluene	2-Hexanone	4-Chlorotoluene	4-Methyl-2-Pentanone (Methyl isobutyl ketone)	Acetone	Benzene	Bromobenzene	Bromochloromethane	Bromodichloromethane	Bromoform (Tribromomethane)	Bromomethane	Carbon Disulfide	Carbon Tetrachloride	Chlorobenzene	Chloroethane	Chloroform	Chloromethane	cis-1,2-Dichloroethene	Cis-1,3-Dichloropropene	Dibromochloromethane	Dibromomethane
				(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
MW-100	MW-100-130919	9/19/2013	Primary																				0.50 U			
MW-101A	MW-101A-130917	9/17/2013	Primary																				0.50 U			
MW-101B	MW-101B-130917	9/17/2013	Primary																				0.50 U			
MW-102	MW-102-130917	9/17/2013	Primary																				0.50 U			
MW-103	MW-103-130918	9/18/2013	Primary																				0.50 U			
MW-104A	MW-104A-130927	9/27/2013	Primary																				0.50 U			
MW-104B	MW-104B-130927	9/27/2013	Primary																				0.50 U			
MW-107	MW-107-130920	9/20/2013	Primary																				0.50 U			
MW-109	MW-109-130918	9/18/2013	Primary																				0.50 U			
MW-110	MW-110-130920	9/20/2013	Primary																				0.50 U			
MW-111	MW-111-130919	9/19/2013	Primary																				0.50 U			
MW-4A	MW-4A-130926	9/26/2013	Primary																				0.50 U			
MW-4B	DUP-5-130926	9/26/2013	Duplicate																				0.50 U			
MW-4B	MW-4B-130926	9/26/2013	Primary																				0.50 U			
MW-93-02	MW-93-02-130920	9/20/2013	Primary																				0.50 U			
MW-96-15	MW-96-15-130917	9/17/2013	Primary																				0.50 U			
MW-96-16	MW-96-16-130918	9/18/2013	Primary																				0.50 U			
MW-96-17	MW-96-17-130918	9/18/2013	Primary																				0.50 U			
MW-ES-02	MW-ES-02-130920	9/20/2013	Primary																				0.50 U			
MW-ES-03	MW-ES-03-130919	9/19/2013	Primary																				0.50 U			
MW-ES-04	MW-ES-04-130919	9/19/2013	Primary																				0.50 U			
MW-ES-05	DUP-2-130920	9/20/2013	Duplicate																				0.50 U			
MW-ES-05	MW-ES-05-130920	9/20/2013	Primary																				0.50 U			
MW-ES-06	MW-ES-06-130920	9/20/2013	Primary																				0.50 U			
MW-ES-07	MW-ES-07-130917	9/17/2013	Primary																				0.50 U			
MW-ES-08	MW-ES-08-130919	9/19/2013	Primary																				0.50 U			
MW-ES-09	MW-ES-09-130926	9/26/2013	Primary																				0.50 U			
MW-ES-10	MW-ES-10-130926	9/26/2013	Primary																				1.0 U			
MW-ES-11	DUP-1-130917	9/17/2013	Duplicate																				0.50 U			
MW-ES-11	MW-ES-11-130917	9/17/2013	Primary																				0.50 U			
MW-UI	MW-UI-130919	9/19/2013	Primary																				0.50 U			
PZ-704	PZ-704-130923	9/23/2013	Primary																				0.50 UJ			
PZ-709	PZ-709-130923	9/23/2013	Primary	5.0 UJ	1.0 UJ	0.20 UJ	2.0 UJ	0.20 UJ	2.0 UJ	19 J	0.20 UJ	0.20 UJ	0.20 UJ	0.20 UJ	1.0 UJ	0.20 UJ	0.20 UJ	0.20 UJ	0.20 UJ	1.0 UJ	0.20 UJ	1.0 UJ	0.20 UJ	0.20 UJ	0.20 UJ	0.20 UJ
PZ-715	PZ-715-130923	9/23/2013	Primary																				0.50 UJ			

Location	Sample ID	Date	Type	2-Butanone (MEK)	2-Chloroethyl vinyl ether	2-Chlorotoluene	2-Hexanone	4-Chlorotoluene	4-Methyl-2-Pentanone (Methyl isobutyl ketone)	Acetone	Benzene	Bromobenzene	Bromochloromethane	Bromodichloromethane	Bromoform (Tribromomethane)	Bromomethane	Carbon Disulfide	Carbon Tetrachloride	Chlorobenzene	Chloroethane	Chloroform	Chloromethane	cis-1,2-Dichloroethene	Cis-1,3-Dichloropropene	Dibromochloromethane	Dibromomethane
				(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
PZ-719	PZ-719-130924	9/24/2013	Primary																				0.50 U			
PZ-720	PZ-720-130924	9/24/2013	Primary																				0.50 U			
PZ-721	DUP-4-130924	9/24/2013	Duplicate																				**0.54**			
PZ-721	PZ-721-130924	9/24/2013	Primary																				**0.51**			
PZ-722	PZ-722-130925	9/25/2013	Primary																				0.50 U			
PZ-723	PZ-723-130925	9/25/2013	Primary																				0.50 U			
PZ-724	PZ-724-130925	9/25/2013	Primary																				**0.59**			
PZ-725	PZ-725-130924	9/24/2013	Primary																				0.50 U			
PZ-726	PZ-726-130925	9/25/2013	Primary																				0.50 U			
PZ-728	PZ-728-130925	9/25/2013	Primary																				0.50 U			
RPZ-730	RPZ-730-130924	9/24/2013	Primary																				0.50 U			
RPZ-731	RPZ-731-130924	9/24/2013	Primary																				0.50 U			
RPZ-732	RPZ-732-130924	9/24/2013	Primary																				0.50 U			
WDOT-MW-1	WSDOT-MW-1-130918	9/18/2013	Primary																				0.50 U			
WDOT-MW-2	WSDOT-MW-2-130918	9/18/2013	Primary																				0.50 U			

Location	Sample ID	Date	Type	Dichlorodifluoromethane (CFC-12) (µg/L)	Ethylbenzene (µg/L)	Hexachlorobutadiene (µg/L)	Isopropylbenzene (Cumene) (µg/L)	Methyl Iodide (Iodomethane) (µg/L)	Methyl t-butyl ether (µg/L)	Methylene Chloride (µg/L)	Naphthalene (µg/L)	n-Butylbenzene (µg/L)	n-Propylbenzene (µg/L)	p-Isopropyltoluene (µg/L)	Sec-Butylbenzene (µg/L)	Styrene (µg/L)	Tert-Butylbenzene (µg/L)	Tetrachloroethene (µg/L)	Toluene (µg/L)	Trans-1,2-Dichloroethene (µg/L)	Trans-1,3-Dichloropropene (µg/L)	Trichloroethene (µg/L)	Trichlorofluoromethane (CFC-11) (µg/L)	Vinyl Acetate (µg/L)	Vinyl Chloride (µg/L)	Xylene, m-,p- (µg/L)	Xylene, o- (µg/L)
MW-100	MW-100-130919	9/19/2013	Primary															0.50 U		0.50 U		0.50 U			0.50 U		
MW-101A	MW-101A-130917	9/17/2013	Primary															0.50 U		0.50 U		0.50 U			0.50 U		
MW-101B	MW-101B-130917	9/17/2013	Primary															0.50 U		0.50 U		3.3			0.50 U		
MW-102	MW-102-130917	9/17/2013	Primary															0.50 U		0.50 U		0.50 U			0.50 U		
MW-103	MW-103-130918	9/18/2013	Primary															0.50 U		0.50 U		0.50 U			0.50 U		
MW-104A	MW-104A-130927	9/27/2013	Primary															0.50 U		0.50 U		4.6			0.50 U		
MW-104B	MW-104B-130927	9/27/2013	Primary															1.5		0.50 U		0.50 U			0.50 U		
MW-107	MW-107-130920	9/20/2013	Primary															0.50 U		0.50 U		0.50 U			0.50 U		
MW-109	MW-109-130918	9/18/2013	Primary															0.50 U		0.50 U		16			0.50 U		
MW-110	MW-110-130920	9/20/2013	Primary															0.50 U		0.50 U		0.50 U			0.50 U		
MW-111	MW-111-130919	9/19/2013	Primary															0.50 U		0.50 U		9.2			0.50 U		
MW-4A	MW-4A-130926	9/26/2013	Primary															0.50 U		0.50 U		0.50 U			0.50 U		
MW-4B	DUP-5-130926	9/26/2013	Duplicate															0.50 U		0.50 U		0.50 U			0.50 U		
MW-4B	MW-4B-130926	9/26/2013	Primary															0.50 U		0.50 U		0.50 U			0.50 U		
MW-93-02	MW-93-02-130920	9/20/2013	Primary															0.50 U		0.50 U		0.50 U			0.50 U		
MW-96-15	MW-96-15-130917	9/17/2013	Primary															0.50 U		0.50 U		0.50 U			0.50 U		
MW-96-16	MW-96-16-130918	9/18/2013	Primary															0.50 U		0.50 U		0.50 U			0.50 U		
MW-96-17	MW-96-17-130918	9/18/2013	Primary															0.50 U		0.50 U		0.50 U			0.50 U		
MW-ES-02	MW-ES-02-130920	9/20/2013	Primary															0.50 U		0.50 U		39			0.50 U		
MW-ES-03	MW-ES-03-130919	9/19/2013	Primary															0.50 U		0.50 U		18			0.50 U		
MW-ES-04	MW-ES-04-130919	9/19/2013	Primary															32		0.50 U		0.50 U			0.50 U		
MW-ES-05	DUP-2-130920	9/20/2013	Duplicate															0.50 U		0.50 U		27			0.50 U		
MW-ES-05	MW-ES-05-130920	9/20/2013	Primary															0.50 U		0.50 U		27			0.50 U		
MW-ES-06	MW-ES-06-130920	9/20/2013	Primary															27		0.50 U		0.76			0.50 U		
MW-ES-07	MW-ES-07-130917	9/17/2013	Primary															0.50 U		0.50 U		7.0			0.50 U		
MW-ES-08	MW-ES-08-130919	9/19/2013	Primary															0.50 U		0.50 U		0.50 U			0.50 U		
MW-ES-09	MW-ES-09-130926	9/26/2013	Primary															1.0 U		1.0 U		120			1.0 U		
MW-ES-10	MW-ES-10-130926	9/26/2013	Primary															0.50 U		0.50 U		36			0.50 U		
MW-ES-11	DUP-1-130917	9/17/2013	Duplicate															0.50 U		0.50 U		0.50 U			0.50 U		
MW-ES-11	MW-ES-11-130917	9/17/2013	Primary															0.50 U		0.50 U		0.50 U			0.50 U		
MW-UI	MW-UI-130919	9/19/2013	Primary															0.50 U		0.50 U		6.6			0.50 U		
PZ-704	PZ-704-130923	9/23/2013	Primary															0.50 UJ		0.50 UJ		0.50 UJ			0.50 UJ		
PZ-709	PZ-709-130923	9/23/2013	Primary	0.20 UJ	0.20 UJ	0.20 UJ	0.20 UJ	1.0 UJ	0.20 UJ	1.0 UJ	1.0 UJ	0.20 UJ	0.20 UJ	0.20 UJ	0.20 UJ	0.20 UJ	0.20 UJ	0.20 UJ	1.0 UJ	0.20 UJ	0.20 UJ	0.20 UJ	0.20 UJ	1.0 UJ	0.20 UJ	0.40 UJ	0.20 UJ
PZ-715	PZ-715-130923	9/23/2013	Primary															0.50 UJ		0.50 UJ		0.50 UJ			0.50 UJ		

Location	Sample ID	Date	Type	Dichlorodifluoromethane (CFC-12)	Ethylbenzene	Hexachlorobutadiene	Isopropylbenzene (Cumene)	Methyl Iodide (Iodomethane)	Methyl t-butyl ether	Methylene Chloride	Naphthalene	n-Butylbenzene	n-Propylbenzene	p-Isopropyltoluene	Sec-Butylbenzene	Styrene	Tert-Butylbenzene	Tetrachloroethene	Toluene	Trans-1,2-Dichloroethene	Trans-1,3-Dichloropropene	Trichloroethene	Trichlorofluoromethane (CFC-11)	Vinyl Acetate	Vinyl Chloride	Xylene, m-,p-	Xylene, o-
				(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
PZ-719	PZ-719-130924	9/24/2013	Primary															0.50 U		0.50 U		**2.1**			0.50 U		
PZ-720	PZ-720-130924	9/24/2013	Primary															**0.55**		0.50 U		**9.7**			0.50 U		
PZ-721	DUP-4-130924	9/24/2013	Duplicate															0.50 U		0.50 U		**54**			0.50 U		
PZ-721	PZ-721-130924	9/24/2013	Primary															0.50 U		0.50 U		**54**			0.50 U		
PZ-722	PZ-722-130925	9/25/2013	Primary															0.50 U		0.50 U		0.50 U			0.50 U		
PZ-723	PZ-723-130925	9/25/2013	Primary															0.50 U		0.50 U		0.50 U			0.50 U		
PZ-724	PZ-724-130925	9/25/2013	Primary															0.50 U		0.50 U		**43**			0.50 U		
PZ-725	PZ-725-130924	9/24/2013	Primary															0.50 U		0.50 U		0.50 U			0.50 U		
PZ-726	PZ-726-130925	9/25/2013	Primary															0.50 U		0.50 U		**3.8**			0.50 U		
PZ-728	PZ-728-130925	9/25/2013	Primary															0.50 U		0.50 U		**5.1**			0.50 U		
RPZ-730	RPZ-730-130924	9/24/2013	Primary															0.50 U		0.50 U		0.50 U			0.50 U		
RPZ-731	RPZ-731-130924	9/24/2013	Primary															0.50 U		0.50 U		**1.6**			0.50 U		
RPZ-732	RPZ-732-130924	9/24/2013	Primary															0.50 U		0.50 U		0.50 U			0.50 U		
WDOT-MW-1	WSDOT-MW-1-130918	9/18/2013	Primary															0.50 U		0.50 U		0.50 U			0.50 U		
WDOT-MW-2	WSDOT-MW-2-130918	9/18/2013	Primary															0.50 U		0.50 U		0.50 U			0.50 U		

Notes:

µg/L = micrograms per liter

U = not detected at or above the reported detection limit

R = rejected result

J = estimated result detected below the reporting detection limit and above the method detection limit

UJ = not detected at or above the listed detection limit; the limit is an approximate value

Bold = detected result above the method detection limit.

Table B-4

Subdrain Results

Fall 2013 Groundwater Monitoring Report
Palermo Wellfield Superfund Site
Tumwater, Washington

Location	Sample ID	Date	Type	1,1-Dichloroethene (µg/L)	cis-1,2-Dichloroethene (µg/L)	Tetrachloroethene (µg/L)	Trans-1,2-Dichloroethene (µg/L)	Trichloroethene (µg/L)	Vinyl Chloride (µg/L)
Sub-Drain System									
350	350-131003	10/3/2013	Primary	0.50 U	0.50 U	0.50 U	0.50 U	**1.4**	0.50 U
356	356-131003	10/3/2013	Primary	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
357	357-131003	10/3/2013	Primary	0.50 U	0.50 U	**10**	0.50 U	**10**	0.50 U
358	358-131003	10/3/2013	Primary	0.50 U	0.50 U	**7.2**	0.50 U	**16**	0.50 U
358	DUP-7-131003	10/3/2013	Duplicate	0.50 U	0.50 U	**9.9**	0.50 U	**10**	0.50 U
359	359-131003	10/3/2013	Primary	0.50 U	0.50 U	**4.8**	0.50 U	**12**	0.50 U
360	360-131003	10/3/2013	Primary	0.50 U	0.50 U	**4.3**	0.50 U	**11**	0.50 U
361	361-131003	10/3/2013	Primary	0.50 U	0.50 U	0.50 U	0.50 U	**0.92**	0.50 U
364	364-131003	10/3/2013	Primary	0.50 U	0.50 U	0.50 U	0.50 U	**0.50**	0.50 U
Seeps									
Seep 1	SEEP1-131002	10/2/2013	Primary	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ
Seep 2	SEEP2-131002	10/2/2013	Primary	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ
Seep 3	SEEP3-131002	10/2/2013	Primary	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ
Seep 5	DUP06-131002	10/2/2013	Duplicate	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ
Seep 5	SEEP5-131002	10/2/2013	Primary	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ
Wellfield Samples									
ST-2	ST-2-130918	9/18/2013	Primary	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
TW-4	TW-4-130918	9/18/2013	Primary	0.50 U	0.50 U	0.50 U	0.50 U	**1.3**	0.50 U
TW-5	TW-5-130918	9/18/2013	Primary	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
TW-8	TW-8-130918	9/18/2013	Primary	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U

Notes:

µg/L = micrograms per liter

U = not detected at or above the reported detection limit

R = rejected result

J = estimated result detected below the reporting detection limit and above the method detection limit

UJ = not detected at or above the listed detection limit; the limit is an approximate value

Bold = detected result above the method detection limit.

APPENDIX C
Data Validation Reports

GROUNDWATER DATA VALIDATION SUMMARY
VOLATILE ORGANIC COMPOUNDS BY METHOD SW8260B

Laboratory SDG	Samples Validated (bold indicates the sample was qualified)
L623994	MW-101A 130306, MW-101B 130305 26.5 FT, MW-102 130305 20 FT, MW-103 130306, **MW-ES-07 130305 30 FT**, MW-ES-11 130306, WDOT-MW-2 130306, TB-2 130305
L623995	MW-100 130305, MW-107 130306, MW-109 130305, MW-110 130306, DUP-1 130306, MW-96-16 130306, MW-96-17 130306, MW-UI 130305, MW-ES-08 130305, TB-1 130305
L624126	MW-104A 130307, MW-111 130307, MW-ES-03 130307, DUP-2_130307, MW-ES-04 130308, MW-ES-05 130308, MW-ES-06 130308, WDOT-MW-1 130307, RIN-2 130308, TB-4 130308
L624134	350 130308, 356 130308, **357 130308**, **DUP-3 130308**, **358 130308**, **359 130308**, 360 130308, 361 130308, 364 130308, **RIN-3 130308**, **TB-5 130308**
L624169	**MW-96-15 130307**, MW-ES-02 130307, PZ-728 130307, ST-2 130307, TW-4 130307, TW-5 130307, TW-8 130307, RIN-1 130307, TB-3 130307
L624938	**MW-104B 130311**, MW-4A 130312, MW-4B 130312, MW-93-02 130312, **MW-ES-09 130311**, **MW-ES-10 130311**, PZ-726 130312, RPZ-732 130312, TB-6 130311
L625509	PZ-704 130313, **PZ-709 130313**, PZ-715 130313, PZ-719 130314, PZ-720 130314, PZ-721 130314, PZ-722 130314, PZ-723 130314, PZ-724 130314, PZ-725 130314, RPZ-730 130313, RPZ-731 130313, DUP-4 130314, TB-7 0130313
L626394	**SEEP-1 130319, SEEP-2 130319, SEEP-3 130319, SEEP-5 130319, DUP-5 130319, TB-8 130319**

PROJECT: PALERMO WELLFIELD RI/FS (0180-121-09)

This report documents the results of an Environmental Protection Agency (EPA) level 2B data validation of analytical data from the analyses of groundwater samples and the associated laboratory and field quality control (QC) samples. The review included the following:

- Chain of Custody
- Holding Times and Sample Preservation
- Surrogates
- Method and Trip Blanks
- Laboratory Control Samples
- Matrix Spikes/Matrix Spike Duplicates
- Laboratory and Field Duplicates
- Internal Standards
- Initial and Continuing Calibrations
- Reporting Limits and Miscellaneous

OBJECTIVE

The objective of the data validation was to review laboratory analytical procedures and quality control (QC) results to evaluate whether:

- The samples were analyzed using well-defined and acceptable methods that provide detection limits below applicable regulatory criteria;
- The precision and accuracy of the data are well defined and sufficient to provide defensible data; and
- The quality assurance/quality control (QA/QC) procedures utilized by the laboratory meet acceptable industry practices and standards.

DATA PACKAGE COMPLETENESS

Environmental Science Corp., located in Mt. Juliet, Tennessee, analyzed the groundwater samples evaluated as part of this data quality assessment. The laboratory provided all required deliverables for the assessment according to the National Functional Guidelines with minor adjustments. The laboratory followed adequate corrective action processes and all identified anomalies were discussed in the case narrative.

DATA QUALITY ASSESSMENT SUMMARY

The results for each of the QC elements are summarized below. The data assessment was performed using guidance in the USEPA Contract Laboratory Program *National Functional Guidelines for Organic Data Review* (USEPA, 2008).

Chain-of-Custody Documentation

Chain-of-custody (COC) forms were provided with the laboratory analytical reports. There were no anomalies noted on the COC forms; proper COC protocols appear to have been followed for this sampling event.

Holding Times and Sample Preservation

The holding time is defined as the time that elapses between sample collection and sample analysis. Maximum holding time criteria exist for each analysis to help ensure that the analyte concentrations found at the time of analysis reflect the concentration present at the time of sample collection. Established holding times were met for all analyses.

Surrogate Recoveries

A surrogate compound is a compound that is chemically similar to the organic analytes of interest, but unlikely to be found in any environmental sample. Surrogates are used for organic analyses and are added to all samples, standards and blanks to serve as an accuracy and specificity check of each analysis. The surrogates are added at a known concentration and percent recoveries are calculated following analysis. All surrogate recoveries for field samples were within the laboratory control limits.

Method and Trip Blanks

Method blanks are analyzed to ensure that laboratory procedures and reagents do not introduce measurable concentrations of the analytes of interest. Method blanks were analyzed with each batch of samples, at a frequency of 1 per 20 samples. For all sample batches, method blanks for all applicable methods were analyzed at the required frequency. None of the analytes of interest were detected above the reporting limits in any of the method blanks.

Trip blanks are analyzed to provide an indication as to whether volatile compounds have cross-contaminated other like samples within the transportation process to the laboratory. Typically, samples are stored in a cooler for as much as 24 hours before arriving at the laboratory. Eight trip blanks were collected: TB-1 130305, TB-2 130305, TB-3 130307, TB-4 130308, TB-5 130308, TB-6 130311, TB-7 0130313 and TB-8 130319. None of the volatiles analytes were detected above the reporting limits in any of the trip blanks, with the exceptions below:

SDG L624938: The laboratory reported a positive result for methylene chloride in the trip blank TB-6 130311. The positive results for this compound were qualified as not-detected (UJ) in the associated field Samples MW-104B 130311, MW-ES-10 130311, and MW-ES-09 130311 because the original results were all less than the reporting limit in each field sample.

SDG L625509: The laboratory reported a positive result for methylene chloride and acetone in the trip blank TB-7 0130313. The positive result for acetone was qualified as not-detected (UJ) in the associated field Sample PZ-709 130313 because the original results were all less than the reporting limit in each sample. There were no other positive results for methylene chloride in the associated samples. No action was necessary for this trip blank contamination.

Equipment rinsate blanks are analyzed to provide an indication as to whether field decontamination and sampling procedures effectively prevent cross-contamination in field activities. Three equipment rinsate blanks were collected: RIN-1 130307, RIN-2 130308 and RIN-3 130308. None of the volatiles analytes were detected above the reporting limits in any of the equipment rinsate blanks.

Matrix Spikes/Matrix Spike Duplicates (MS/MSD)

Because the actual analyte concentration in an environmental sample is not known, the accuracy of a particular analysis is usually inferred by performing a matrix spike (MS) analysis. One aliquot of sample is analyzed in the normal manner, and then a second aliquot of the sample is spiked with a known amount of analyte concentration and analyzed. From these analyses, a percent recovery (%R) is calculated. Matrix spike duplicates (MSD) analyses are generally performed for organic analyses as a precision check.

For matrix spike analyses should be performed once per analytical batch or every 20 field samples, whichever is more frequent. The recovery criteria for matrix spikes and laboratory control samples are specified in the laboratory documents as are the relative percent difference values. The frequency requirements were met for all analyses and the %R/RPD values were within the proper control limits, with the exceptions below:

SDG L623994: The laboratory performed an MS/MSD QC set on Sample MW-ES-07 130305 30 FT. The %R values for 2-chloroethyl-vinyl-ether were below 10% in both the MS and the MSD. There was no positive result for this analyte in the parent sample. The reporting limits for 2-chloroethyl-vinyl-ether were rejected (R) in Sample MW-ES-07 130305 30 FT.

SDG L624134: The laboratory performed an MS/MSD QC set on Sample 364 130308. The %R values for 2-chloroethyl-vinyl-ether were below 10% in both the MS and the MSD. There was no positive result for this analyte in the parent sample. The reporting limits for 2-chloroethyl-vinyl-ether were rejected (R) in Sample 364 130308.

SDG L624169: The laboratory performed an MS/MSD QC set on Sample MW-96-15 130307. The %R values for 2-chloroethyl-vinyl-ether were below 10% in both the MS and the MSD. There was no positive result for this analyte in the parent sample. The reporting limits for 2-chloroethyl-vinyl-ether were rejected (R) in Sample MW-96-15 130307.

SDG L625509: The laboratory performed an MS/MSD QC set on Sample RPZ-731 130313. The %R values for acrolein were greater than the control limits in both the MS and the MSD. There was no positive result for this analyte in the parent sample. No action was required for these outliers.

Also, the %R values for 1,2-dibromoethane, 1,3-dichloropropane, and 2-chloro-ethyl vinyl ether were outside of the control limits in the MSD. However, the corresponding %R values for these analytes were within the control limits in the MS. No action was taken for these outliers because one out of the two MS/MSD samples were within the control limits.

Laboratory Control Samples/Laboratory Control Sample Duplicates (LCS/LCSD)

A laboratory control sample is essentially a blank sample that is spiked with a known amount of analyte concentration and analyzed. It is to be treated much like a matrix spike, without the possibility for matrix interference. As there is no actual sample matrix in the analysis, the analytical expectations for accuracy and precision are usually more rigorous and qualification would apply to all samples in the batch, instead of the parent sample only.

Laboratory control sample analyses should be performed once per analytical batch or every 20 field samples, whichever is more frequent. The recovery criteria for laboratory control samples are specified in the laboratory documents as are the relative percent difference values. The frequency requirements were met for all analyses, and the %R/RPD values were within the proper control limits, with the exceptions below:

SDG L623994: The %R value for 1,2,3-trichlorobenzene was greater than the control limit in the LCS analyzed on March 9, 2013. However, the corresponding %R value for this analyte was within the control limits in the LCSD. No action was taken for this outlier because one out of the two QC samples were within the control limits.

SDG L624126: The %R values for 1,2,3-trichlorobenzene were greater than the control limits in the second LCS/LCSD analyzed on March 10, 2013. There were no positive results for this analyte in any of the field samples. As these outliers were indicative of a high bias, no action was taken.

SDG L624134: The %R value for 1,2,3-trichlorobenzene was greater than the control limit in the first LCS/LCSD analyzed on March 10, 2013. There were no positive results for this analyte in any of the field samples. As these outliers were indicative of a high bias, no action was taken.

The %R value for 2-chlorotoluene was greater than the control limit in the second LCS analyzed on March 10, 2013. However, the corresponding %R value for this analyte was within the control limits in the LCSD. No action was taken for this outlier because one out of the two QC samples were within the control limits.

The %R value for 1,1,2-trichlorotrifluoroethane was less than the control limit in the second LCS/LCSD analyzed on March 10, 2013. There were no positive results for this analyte in any of the field samples. The reporting limits for this analyte were qualified as estimated (UJ) in Samples 357 130308, 358 130308, 359 130308, DUP-3 130308, RIN-3 130308, and TB-5 130308.

The RPD values for 1,1-dichloroethane, acetone, acrolein, acrylonitrile, and di-isopropyl ether, MTBE, and methylene chloride greater than the control limit in the second LCS/LCSD analyzed on March 10, 2013. There were no positive results for these analytes in any of the associated field samples. No action was taken for these outliers.

SDG L624169: The %R value for 1,2,3-trichlorobenzene was greater than the control limit in the LCS analyzed on March 10, 2013. However, the corresponding %R value for this analyte was within the control limits in the LCSD. No action was taken for this outlier because one out of the two QC samples were within the control limits.

The RPD values for 1,2,3-trichlorobenzene, 1,2,4-trichlorobenzene, and naphthalene were greater than the control limit in the LCS/LCSD analyzed on March 10, 2013. There were no positive results for these analytes in any of the associated field samples. No action was taken for these outliers.

SDG L625509: The %R value for 1,3-dichloropropane was greater than the control limit in the LCSD analyzed on the first sample batch on March 19, 2013. However, the corresponding %R value for this analyte was within the control limits in the LCS. No action was taken for this outlier because one out of the two QC samples were within the control limits.

SDG L626394: The %R values for 1,2,3-trichlorobenzene were less than the control limits in the LCS/LCSD analyzed on March 21, 2013. There were no positive results for this analyte in the associated samples. The reporting limits were qualified as estimated (UJ) in all samples in this SDG.

Field Duplicates

Field duplicate samples were collected and analyzed along with the reviewed sample batches. The duplicate samples were analyzed for the same parameters as the associated parent samples. In order to assess precision, the relative percent difference (RPD) is used, unless one or more of the sample analytes has a concentration greater than five times the reporting limit for that sample. In this case the absolute difference is used instead of the RPD.

SDG L623995: One set of field duplicates, MW-110 130306 and DUP-1 130306, were submitted with this SDG. The precision criteria for all volatile target analytes were met for this sample pair.

SDG L624126: One set of field duplicates, MW-ES-03 130307 and DUP-2_130307, were submitted with this SDG. The precision criteria for all volatile target analytes were met for this sample pair.

SDG L624134: One set of field duplicates, 357 130308 and DUP-3 130308, were submitted with this SDG. The precision criteria for all volatile target analytes were met for this sample pair.

SDG L625509: One set of field duplicates, PZ-719 130314 and DUP-4 130314, were submitted with this SDG. The precision criteria for all volatile target analytes were met for this sample pair.

SDG L626394: One set of field duplicates, SEEP-5 130319 and DUP-5 130319, were submitted with this SDG. The precision criteria for all volatile target analytes were met for this sample pair.

Internal Standards (Low Resolution Mass Spectroscopy)

Like the surrogate, an internal standard is a compound that is chemically similar to the analytes of interest, but unlikely to be found in any environmental sample. Internal standards are used only for the mass spectrometry (MS) instrumentation and are usually added to the sample aliquot after extraction has taken place. The internal standard should be analyzed at the beginning of a 12 hour sample run and the control limits for internal standard recoveries are -50% to +100% of the calibration standard. All internal standard recoveries were within the control limits.

Initial Calibrations (ICALs)

All initial calibrations were conducted according to the laboratory methods, and consisted of the appropriate number of standards. All percent relative standard deviation (%RSD) values were less than +/- 30% and all relative response factors (RRF) were greater than 0.05.

All continuing calibrations were conducted according to the laboratory methods, and consisted of the appropriate number of standards. All percent difference (%D) values were less than +/-25% and all relative response factors (RRF) were greater than 0.05.

Reporting Limits and Miscellaneous

The contract required quantitation limits (CRQL) were generally met by the laboratory for all target analytes throughout this sampling event. There may be cases of analytical results that were quantitated even though they were less than the linear calibration range of the instrument, yet greater than the method detection limit. In these cases, the laboratory would indicate any such occurrence with a "J" flag. Any such "J" flags were qualified as estimated (J) in the validation process.

No further validation qualifiers were needed in these cases.

OVERALL ASSESSMENT

As was determined by this data quality assessment, the laboratory followed the specified analytical methods. Accuracy was acceptable, as demonstrated by the surrogate, LCS/LCSD, and MS/MSD %R values. Precision was acceptable, as demonstrated by the field duplicate, laboratory duplicate, LCS/LCSD and MS/MSD RPD values.

Data points for one non-target analyte were rejected because of MS/MSD %R values being less than 10%.

Data points were estimated because of low LCS/LCSD %R values.

Analytical results that were less than the reporting limit, but greater than the method detection limit have been reported and qualified as estimated (J-code).

The data are acceptable for the intended use.

GROUNDWATER DATA VALIDATION SUMMARY
VOLATILE ORGANIC COMPOUNDS BY METHOD SW8260B

Laboratory SDG	Samples Validated (Bold indicates the sample was qualified)
1309-156	MW-96-15-130917, MW-101A-130917, MW-101B-130917, MW-102-130917, MW-ES-07-130917, MW-ES-11-130917, DUP-1-130917, TB-1-130917
1309-169	MW-103-130918, WSDOT-MW-1-130918, WSDOT-MW-2-130918, TB-2-130918
1309-170	MW-96-16-130918, MW-96-17-130918, MW-109-130918, ST-2-130918, TW-4-130918, TW-5-130918, TW-8-130918, TB-3-130918
1309-188	MW-111-130919, MW-ES-03-130919, MW-UI-130919, TB-5-130919
1309-189	MW-100-130919, MW-ES-04-130919, MW-ES-08-130919, TB-4-130919
1309-203	MW-93-02-130920, MW-107-130920, MW-110-130920, RIN-1-130920, TB-7-130920
1309-204	MW-ES-02-130920, MW-ES-05-130920, MW-ES-06-130920, DUP-2-130920, TB-6-130920
1309-209	**PZ-704-130923, PZ-709-130923, PZ-715-130923, TB-8-130923**
1309-228	PZ-719-130924, PZ-720-130924, PZ-721-130924, PZ-725-130924, DUP-4-130924, RPZ-730-130924, RPZ-731-130924, RPZ-732-130924, TB-10-130924
1309-245	PZ-722-130925, PZ-723-130925, PZ-724-130925, PZ-726-130925, PZ-728-130925, TB-12-130925
1309-258	MW-4A-130926, MW-4B-130926, MW-ES-09-130926, MW-ES-10-130926, DUP-5-130926, RIN-2-130926, TB-9-130926
1309-275	MW-104A-130927, MW-104B-130927, RIN-3-130927, TB-11-130927

1310-036	SEEP1-131002, SEEP2-131002, SEEP3-131002, SEEP5-131002, DUP06-131002, TB-13-131002
1310-053	350-131003, 356-131003, 357-131003, 358-131003, 359-131003, 360-131003, 361-1003, 364-131003, DUP-7-131003, RIN-4-131003, TB-14-131003

PROJECT: PALERMO WELLFIELD RI/FS (0180-121-09)

This report documents the results of an Environmental Protection Agency (EPA) Stage 2B data validation of analytical data from the analyses of groundwater samples and the associated laboratory and field quality control (QC) samples. The review included the following:

- Chain-of-Custody Documentation
- Holding Times and Sample Preservation
- Surrogate Recoveries
- Method, Trip, and Rinsate Blanks
- Matrix Spikes/Matrix Spike Duplicates
- Laboratory Control Samples/Laboratory Control Sample Duplicates
- Field Duplicates
- Internal Standards
- Initial Calibrations (ICALs)
- Continuing Calibrations (CCALs)
- Reporting Limits and Miscellaneous

OBJECTIVE

The objective of the data validation was to review laboratory analytical procedures and quality control (QC) results to evaluate whether:

- The samples were analyzed using well-defined and acceptable methods that provide detection limits below applicable regulatory criteria;
- The precision and accuracy of the data are well defined and sufficient to provide defensible data; and
- The quality assurance/quality control (QA/QC) procedures utilized by the laboratory meet acceptable industry practices and standards.

DATA PACKAGE COMPLETENESS

OnSite Environmental, Inc., located in Redmond, Washington, analyzed the groundwater samples evaluated as part of this data quality assessment. The laboratory provided all required deliverables for the assessment according to the National Functional Guidelines with minor adjustments. The laboratory followed adequate corrective action processes and all identified anomalies were discussed in the case narrative.

DATA QUALITY ASSESSMENT SUMMARY

The results for each of the QC elements are summarized below. The data assessment was performed using guidance in the USEPA Contract Laboratory Program *National Functional Guidelines for Organic Data Review* (USEPA, 2008).

Chain-of-Custody Documentation

Chain-of-custody (COC) forms were provided with the laboratory analytical reports. There were no anomalies noted on the COC forms; proper COC protocols appear to have been followed for this sampling event. The samples were transported to the laboratory at the appropriate temperatures of between 2 and 6 degrees Celsius, with the following exceptions:

SDG 1309-209: The sample cooler temperature recorded at the laboratory was 9 degrees Celsius. The positive result for acetone was qualified as estimated (J) in Sample PZ-709-130923. The reporting limits for all target analytes were qualified as estimated (UJ) in Samples PZ-704-130923, PZ-709-130923, PZ-715-130923, and TB-8-130923.

SDG 1310-036: The sample cooler temperature recorded at the laboratory was 14 degrees Celsius. The reporting limits for all target analytes were qualified as estimated (UJ) in Samples SEEP1-131002, SEEP2-131002, SEEP3-131002, SEEP4-131002, SEEP5-131002, DUP06-131002 and TB-13-131002.

Holding Times and Sample Preservation

The holding time is defined as the time that elapses between sample collection and sample analysis. Maximum holding time criteria exist for each analysis to help ensure that the analyte concentrations found at the time of analysis reflect the concentration present at the time of sample collection. Established holding times were met for all analyses, with the following exception:

SDG 1309-209: The preservation criteria for Sample PZ-709-130923 was not met; therefore, reducing the maximum holding time to 7 days. The 7-day holding time of Sample PZ-709-130923 was exceeded by 3 days. The positive result for acetone was qualified as estimated (J) in this sample. The reporting limits for all other target analytes were qualified as estimated (UJ) in this sample.

Surrogate Recoveries

A surrogate compound is a compound that is chemically similar to the organic analytes of interest, but unlikely to be found in any environmental sample. Surrogates are used for organic analyses and are added to all samples, standards, and blanks to serve as an accuracy and specificity check of each analysis. The surrogates are added at a known concentration and percent recoveries are calculated following analysis. All surrogate recoveries for field samples were within the laboratory control limits.

Method, Trip, and Rinsate Blanks

Method blanks are analyzed to ensure that laboratory procedures and reagents do not introduce measurable concentrations of the analytes of interest. Method blanks were analyzed with each batch of samples, at a frequency of 1 per 20 samples. For all sample batches, method blanks for all applicable methods were analyzed at the required frequency. None of the analytes of interest were detected above the reporting limits in any of the method blanks.

Trip blanks are analyzed to provide an indication as to whether volatile compounds have cross-contaminated other like samples within the transportation process to the laboratory. Typically, samples are stored in a cooler for as much as 24 hours before arriving at the laboratory. Fourteen trip blanks were collected: TB-1-130917, TB-2-130918, TB-3-130918, TB-4-130919, TB-5-130919, TB-6-130920, TB-7-130920, TB-8-130923, TB-9-130926, TB-10-130924, TB-11-130927, TB-12-130925, TB-13-131002, and TB-14-131003. None of the analytes of interest were detected above the reporting limits in any of the trip blanks.

Equipment rinsate blanks are analyzed to provide an indication as to whether field decontamination and sampling procedures effectively prevent cross-contamination in field activities. Four equipment rinsate blanks were collected: RIN-1-130920, RIN-2-130926, RIN-3-130927, and RIN-4-131003. None of the analytes of interest were detected above the reporting limits in any of the rinsate blanks.

Matrix Spikes/Matrix Spike Duplicates

Since the actual analyte concentration in an environmental sample is not known, the accuracy of a particular analysis is usually inferred by performing a matrix spike (MS) analysis on one sample from the associated batch, known as the parent sample. One aliquot of the sample is analyzed in the normal manner and then a second aliquot of the sample is spiked with a known amount of analyte concentration and analyzed. From these analyses, a percent recovery (%R) is calculated. Matrix spike duplicate (MSD) analyses are generally performed for organic analyses as a precision check and analyzed in the same sequence as a matrix spike. Using the %R from the MS and MSD, the relative percent difference (RPD) is calculated. The %R control limits for MS and MSD analyses are specified in the laboratory documents, as are the RPD control limits for MS/MSD sample sets.

One MS/MSD analysis should be performed for every analytical batch or every 20 field samples, whichever is more frequent. The frequency requirements were met for all analyses and the %R/RPD values were within the proper control limits.

Laboratory Control Samples/Laboratory Control Sample Duplicates

A laboratory control sample (LCS) is a blank sample that is spiked with a known amount of analyte and then analyzed. An LCS is similar to an MS, but without the possibility of matrix interference. Given that matrix interference is not an issue, the LCS/LCSD control limits for accuracy and precision are usually more rigorous than for MS/MSD analyses. Additionally, data qualification based on LCS/LCSD analyses would apply to all samples in the associated batch, instead of just the parent sample. The %R control limits for LCS and LCSD analyses are specified in the laboratory documents, as are the RPD control limits for LCS/LCSD sample sets.

One LCS/LCSD analysis should be performed for every analytical batch or every 20 field samples, whichever is more frequent. The frequency requirements were met for all analyses and the %R/RPD values were within the proper control limits.

Field Duplicates

Field duplicate samples were collected and analyzed along with the reviewed sample batches. The duplicate samples were analyzed for the same parameters as the associated parent samples. In order to assess precision, the relative percent difference (RPD) is used, unless one or more of the sample analytes has a concentration greater than five times the reporting limit for that sample. In this case, the absolute difference is used instead of the RPD. The RPD control limit for water samples is 35 percent.

SDG 1309-156: One field duplicate sample pair, MW-ES-11-130917 and DUP-1-130917, was submitted with this SDG. The precision criteria for all volatile target analytes were met for this sample pair.

SDG 1309-204: One field duplicate sample pair, MW-ES-05-130920 and DUP-2-130920, was submitted with this SDG. The precision criteria for all volatile target analytes were met for this sample pair.

SDG 1309-228: One field duplicate sample pair, PZ-721-130924 and DUP-4-130924, was submitted with this SDG. The precision criteria for all volatile target analytes were met for this sample pair.

SDG 1309-258: One field duplicate sample pair, MW-4B-130926 and DUP-5-130926, was submitted with this SDG. The precision criteria for all volatile target analytes were met for this sample pair.

SDG 1310-036: One field duplicate sample pair, SEEP5-131002 and DUP06-131002, was submitted with this SDG. The precision criteria for all volatile target analytes were met for this sample pair.

SDG 1310-053: One field duplicate sample pair, 358-131003 and DUP-7-131003, was submitted with this SDG. The precision criteria for all volatile target analytes were met for this sample pair.

Internal Standards (Low Resolution Mass Spectrometry)

Like the surrogate, an internal standard is a compound that is chemically similar to the analytes of interest, but unlikely to be found in any environmental sample. Internal standards are used only for the mass spectrometry instrumentation and are usually added to the sample aliquot after extraction has taken place. The internal standard should be analyzed at the beginning of a 12 hour sample run and the control limits for internal standard recoveries are 50% to 200% of the calibration standard. All internal standard recoveries were within the control limits.

Initial Calibrations (ICALs)

All initial calibrations were conducted according to the laboratory methods and consisted of the appropriate number of standards. All percent relative standard deviation (%RSD) values were less than +/- 30% and all relative response factors (RRF) were greater than 0.05.

Continuing Calibrations (CCALs)

All continuing calibrations were conducted according to the laboratory methods and consisted of the appropriate number of standards. All percent difference (%D) values were less than +/- 25% and all relative response factors (RRF) were greater than 0.05.

Reporting Limits and Miscellaneous

The contract required quantitation limits (CRQL) were generally met by the laboratory for all target analytes throughout this sampling event. There may be cases of analytical results that were quantitated even though they were less than the linear calibration range of the instrument, yet greater than the method detection limit. In these cases, the laboratory would indicate any such occurance with a "J" flag. Any such "J" flags were qualified as estimated (J) in the validation process.

No further validation qualifiers were needed in these cases.

OVERALL ASSESSMENT

As was determined by this data quality assessment, the laboratory followed the specified analytical methods. Accuracy was acceptable, as demonstrated by the surrogate, LCS/LCSD, and MS/MSD %R values. Precision was acceptable, as demonstrated by the LCS/LCSD, MS/MSD, and field duplicate RPD values.

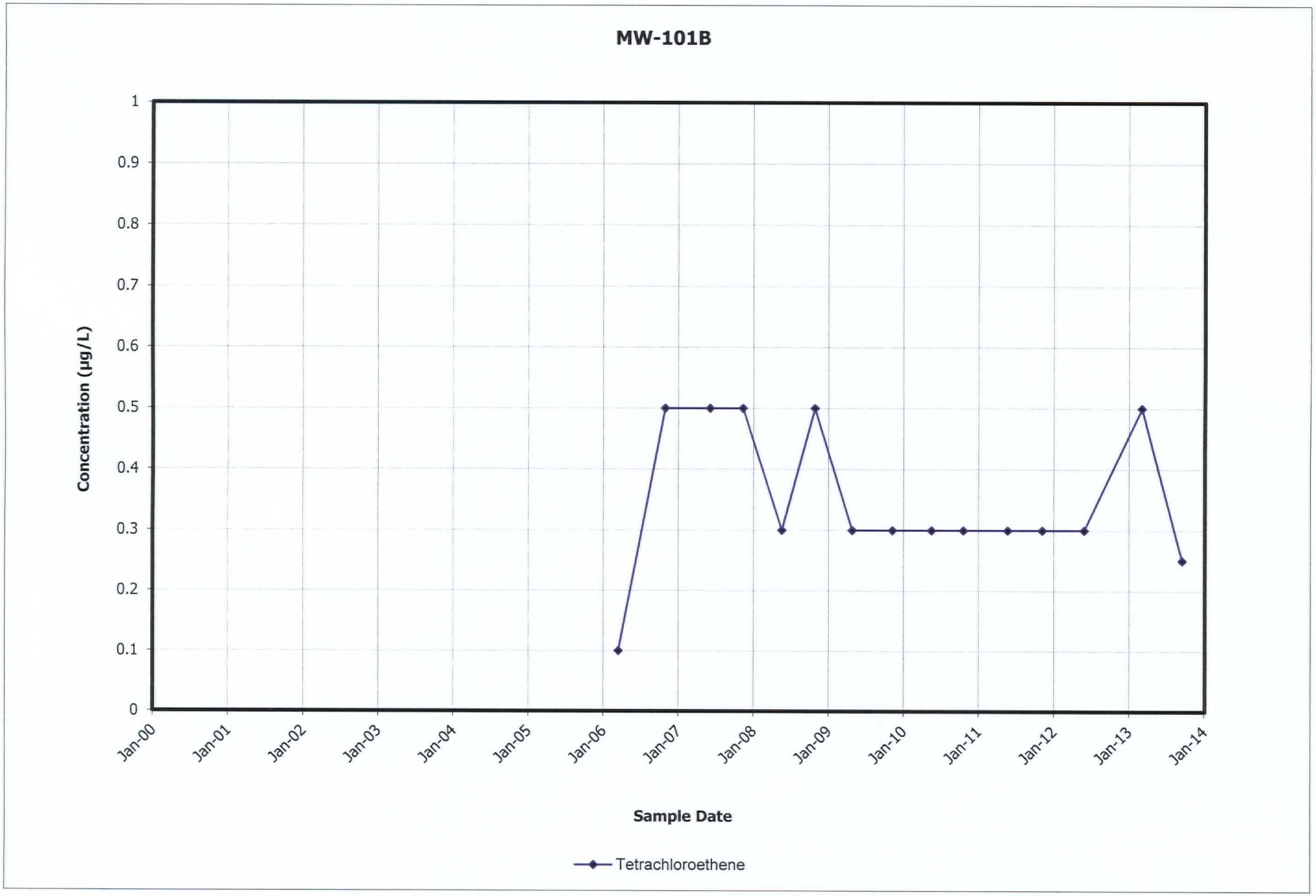
Selected data were qualified as estimated because of temperature and holding time exceedances.

The data are acceptable for the intended use.

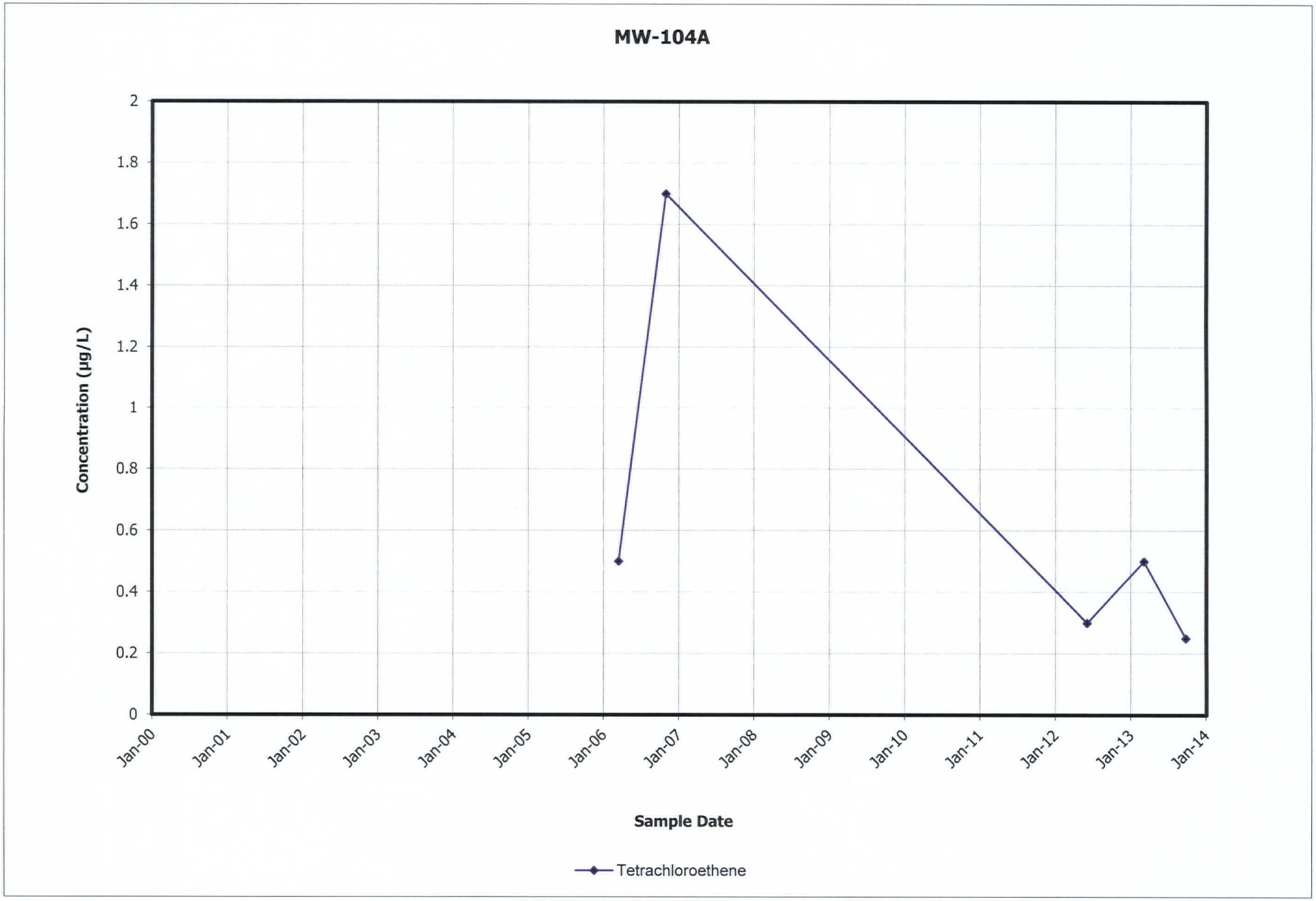
APPENDIX D

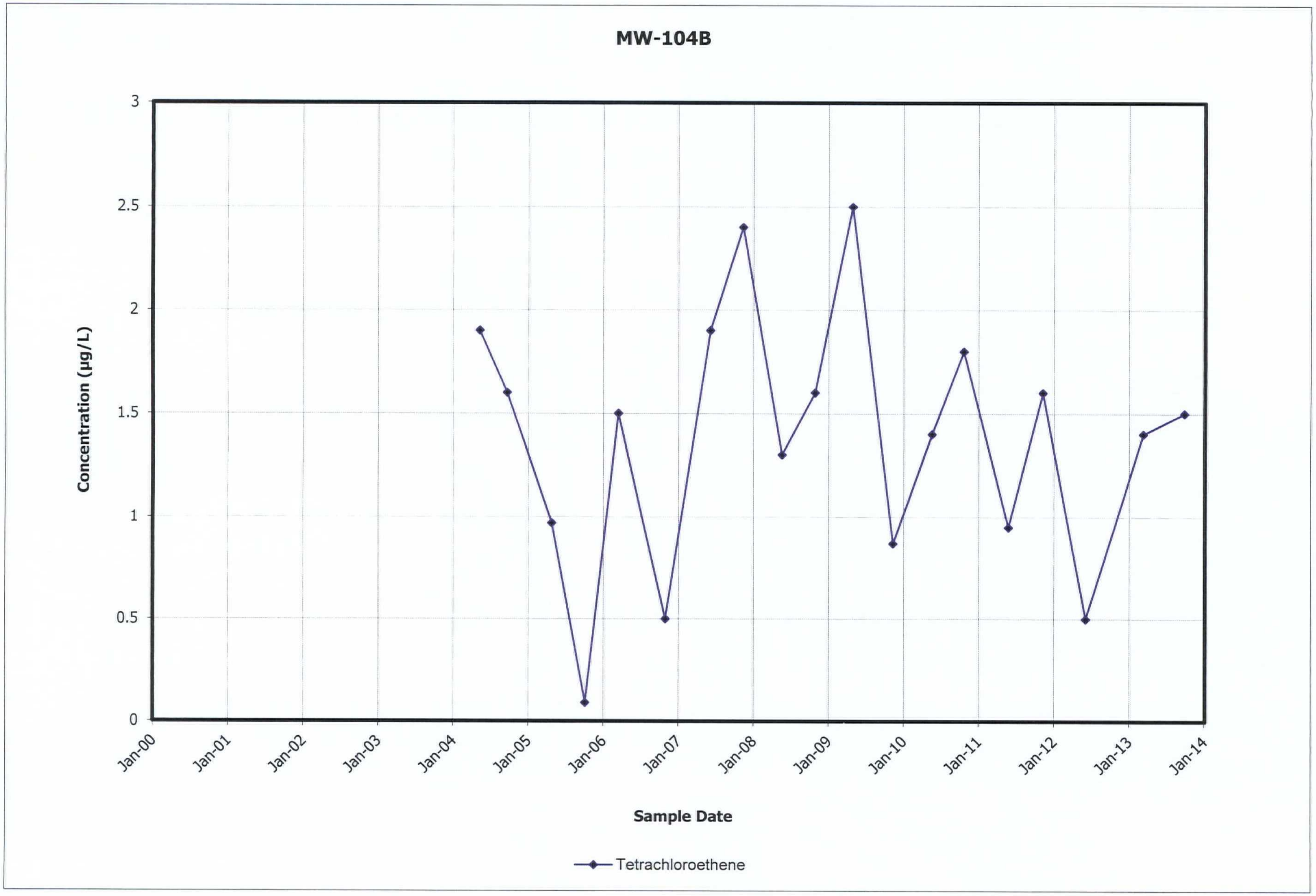
Laboratory Analytical Data Reports
(Included on CD)

APPENDIX E
Trend Plots

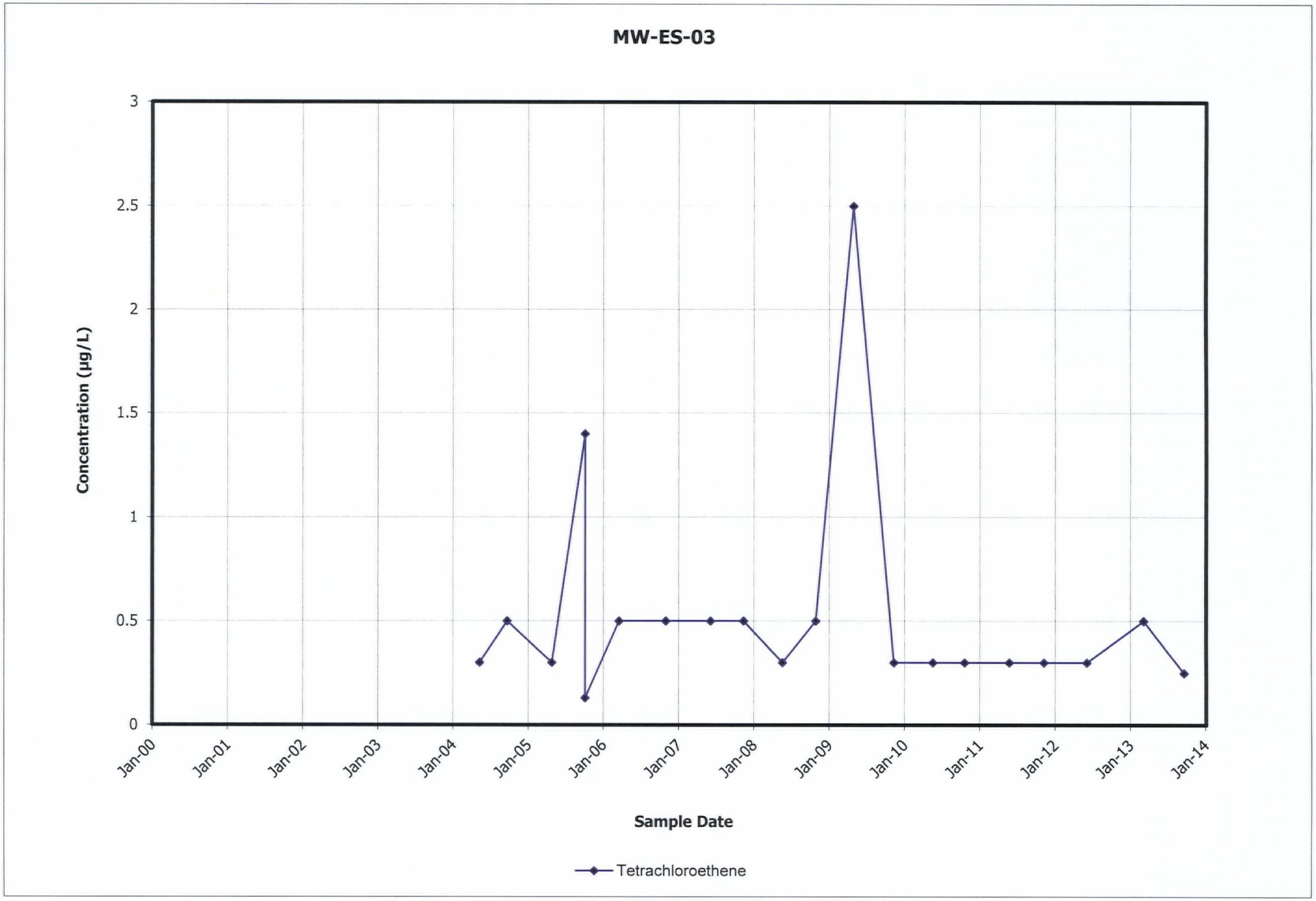


MW-101B
Concentration (µg/L)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Sample Date
Tetrachloroethene

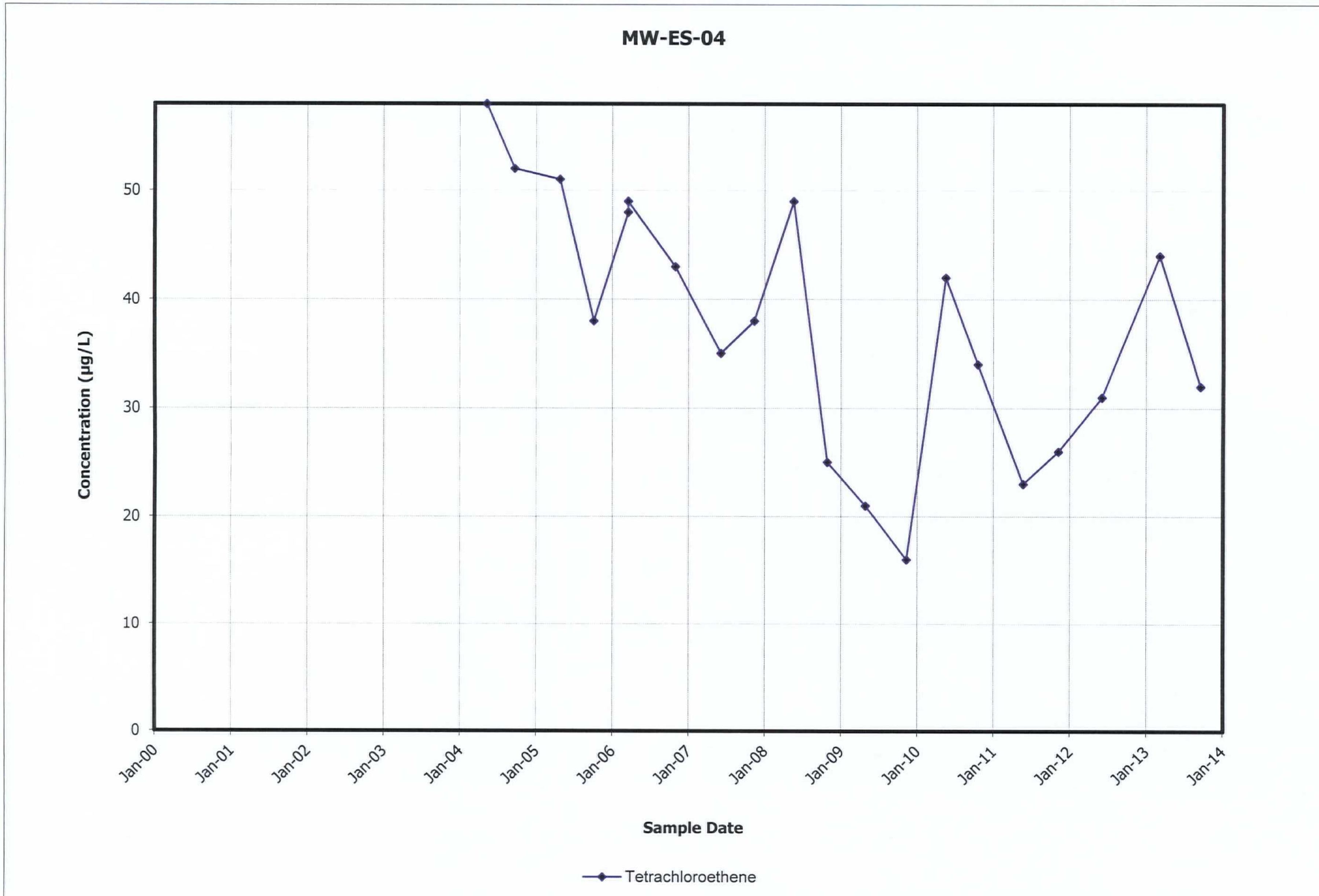

MW-104A
Concentration (µg/L)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Sample Date
Tetrachloroethene

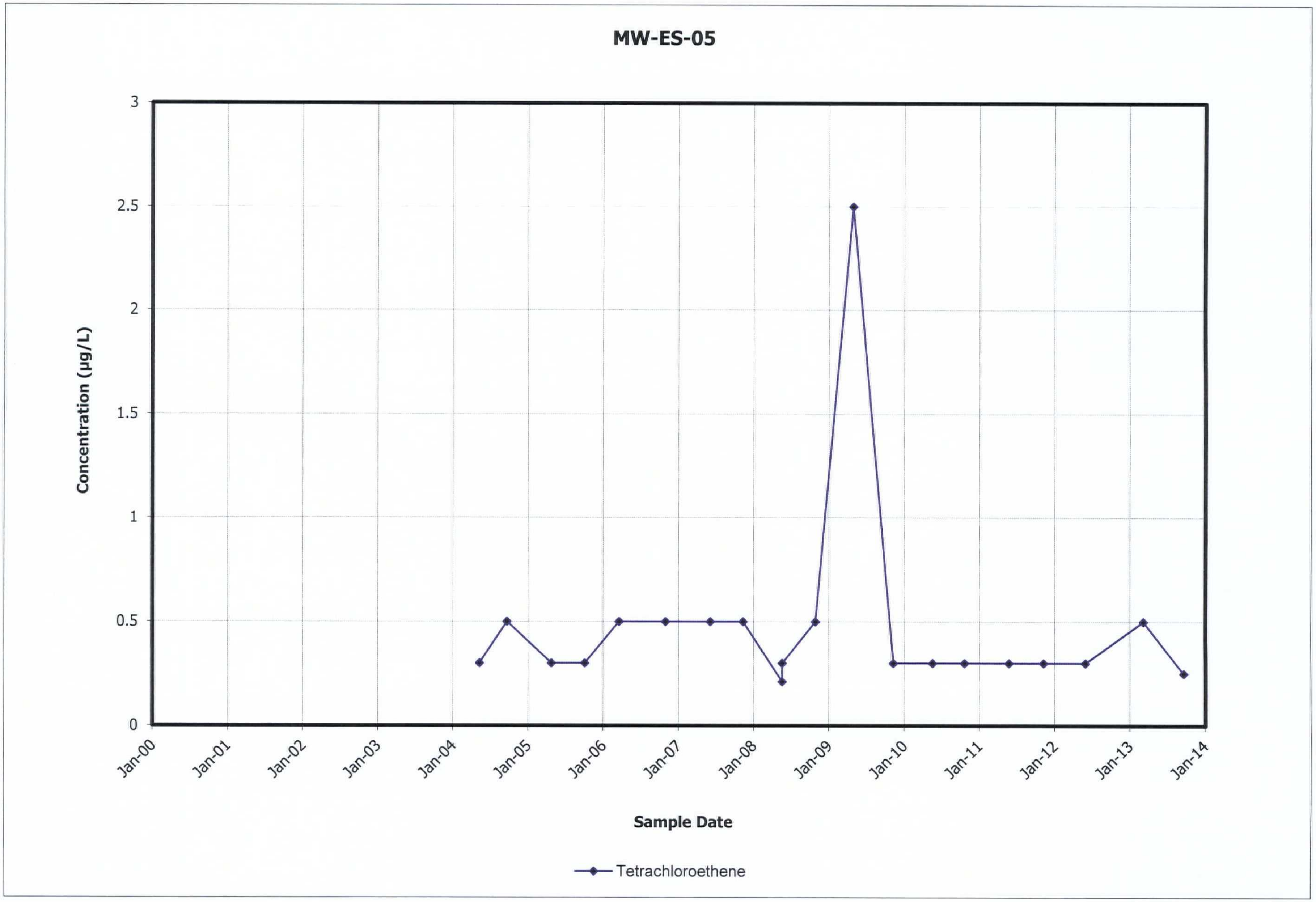


MW-104B
Concentration (µg/L)
0
0.5
1
1.5
2
2.5
3
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Sample Date
Tetrachloroethene

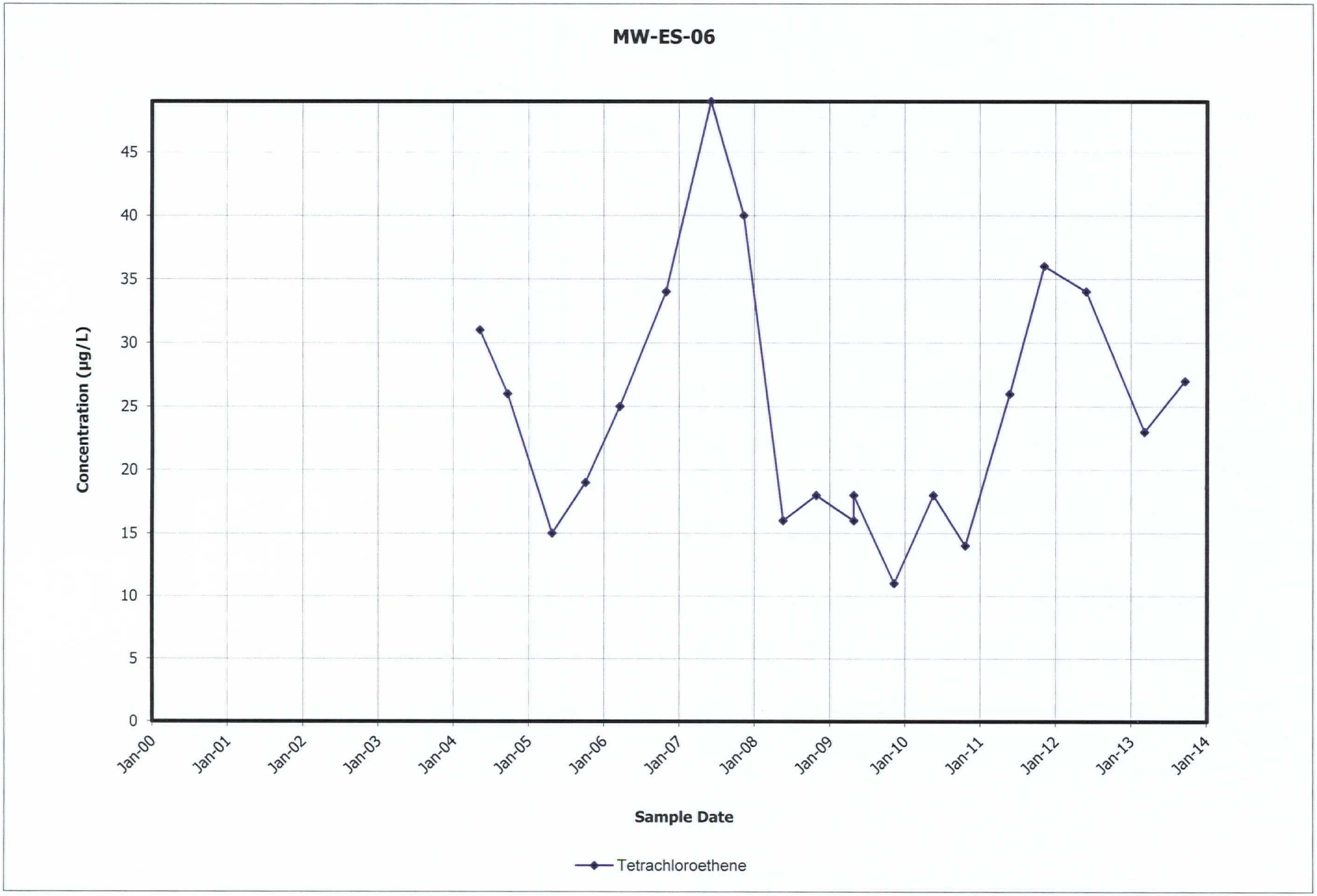


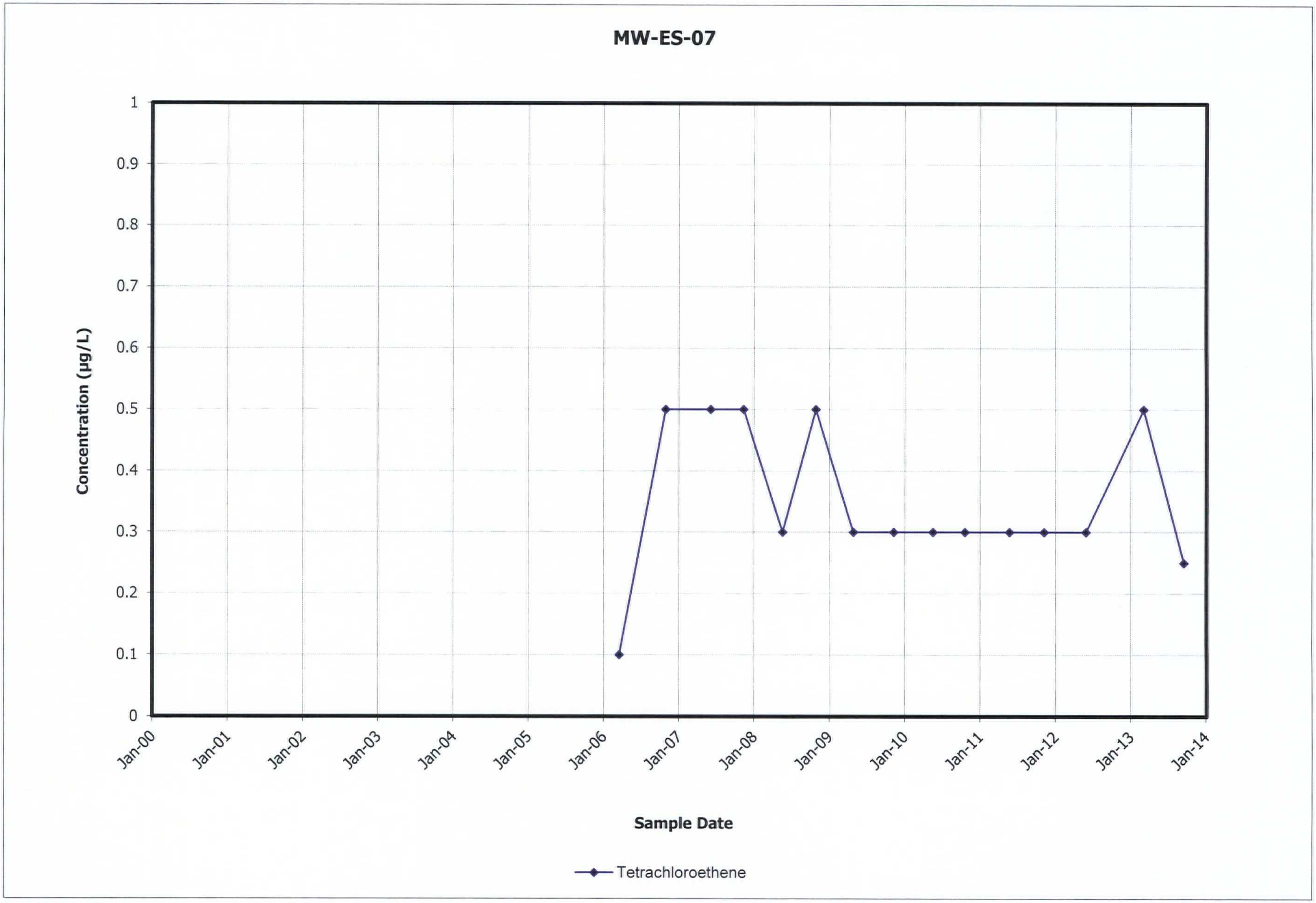
MW-ES-03
Concentration (µg/L)
0
0.5
1
1.5
2
2.5
3
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Sample Date
Tetrachloroethene

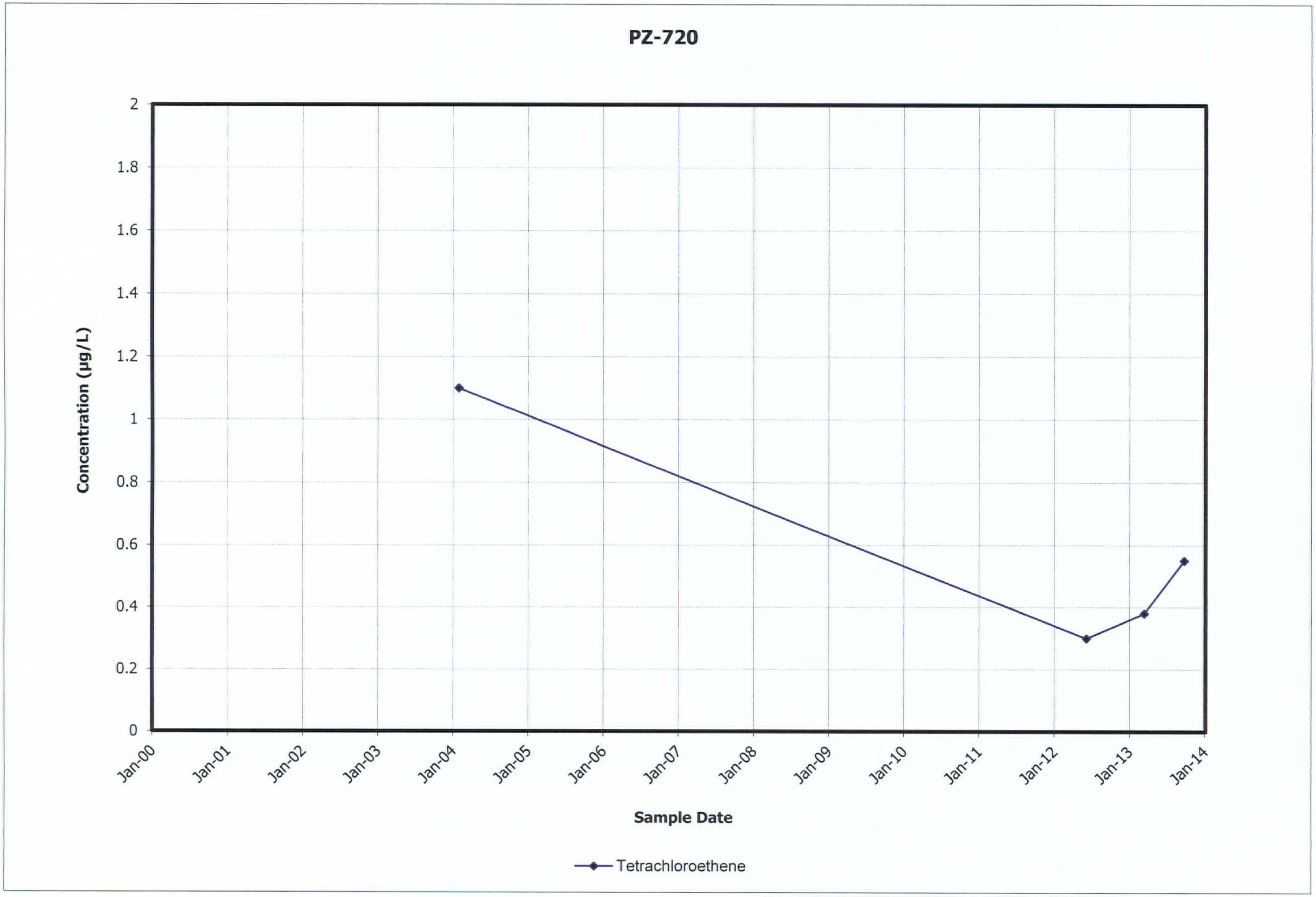

MW-ES-04
Concentration (µg/L)
0
10
20
30
40
50
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Sample Date
Tetrachloroethene

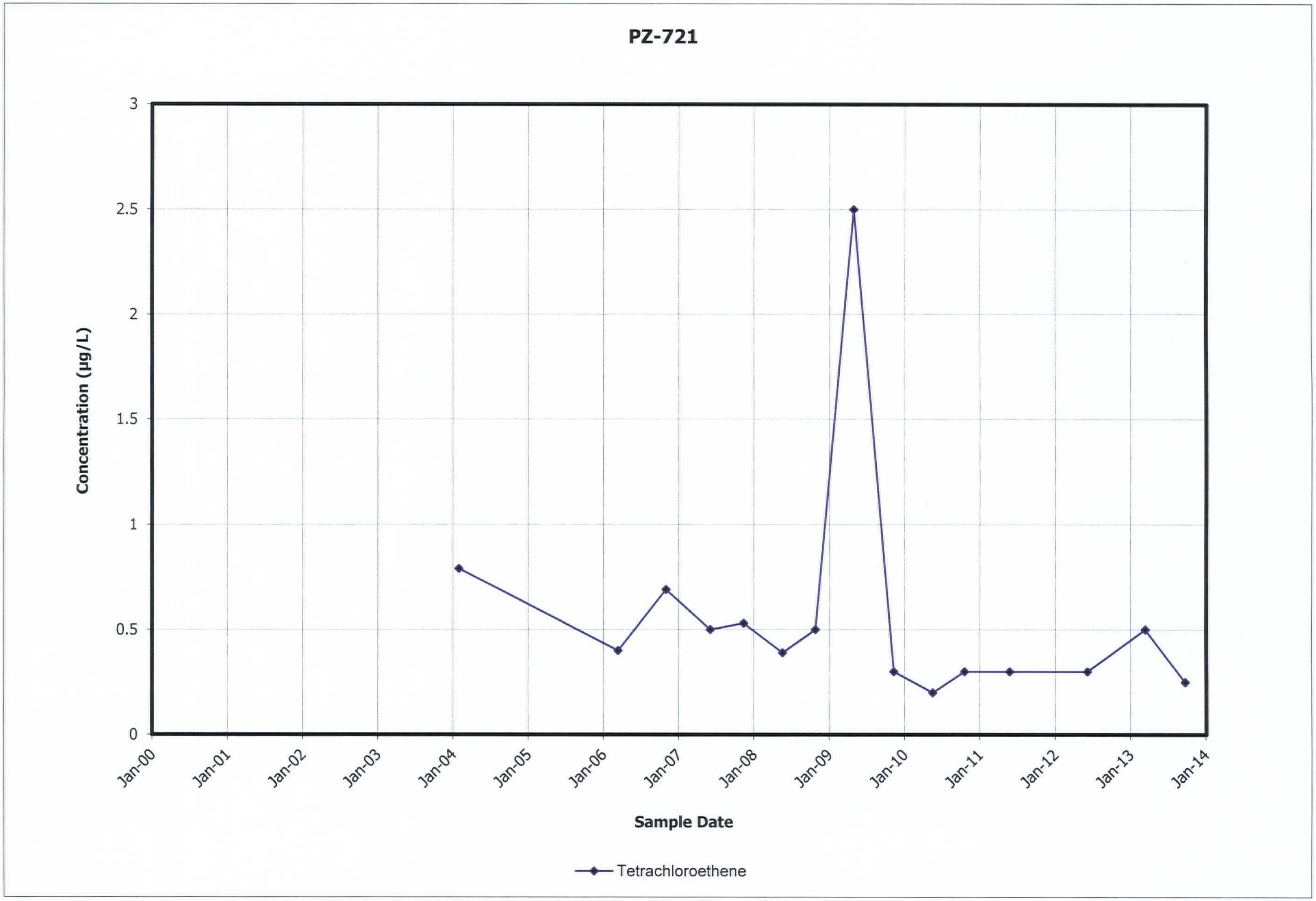


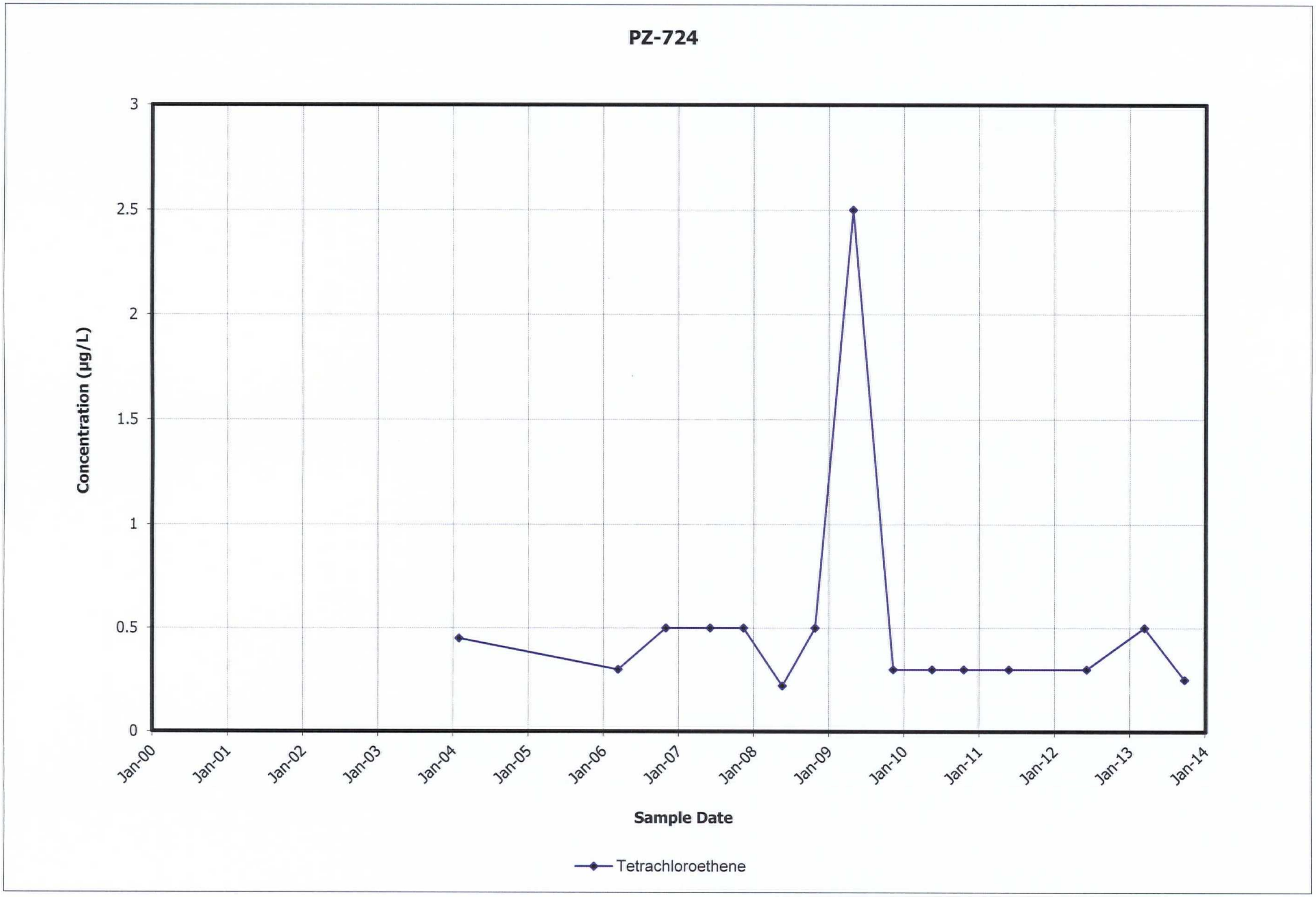
MW-ES-05
Concentration (µg/L)
3
2.5
2
1.5
1
0.5
0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Sample Date
Tetrachloroethene

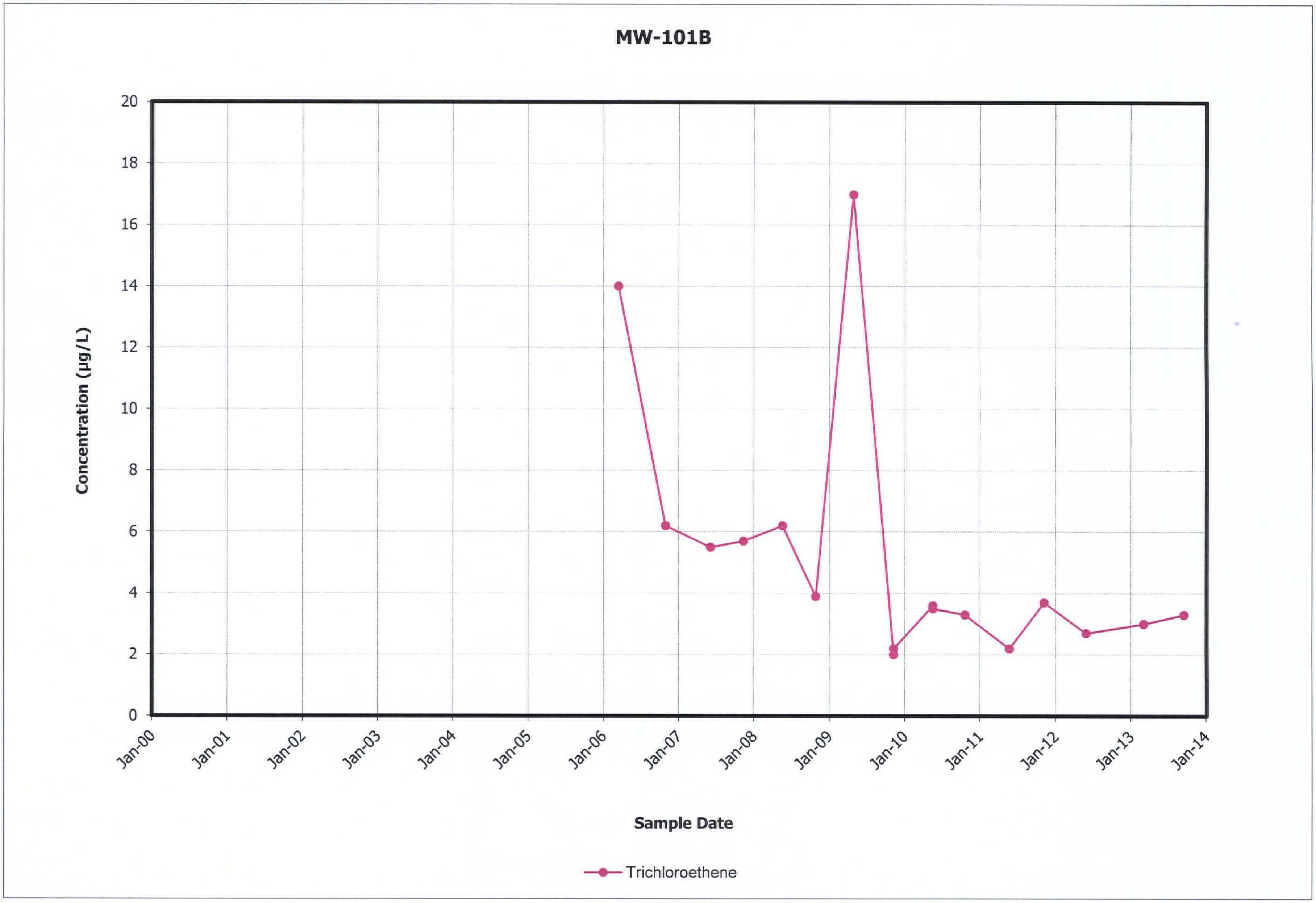

MW-ES-06
Concentration (µg/L)
0
5
10
15
20
25
30
35
40
45
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Sample Date
Tetrachloroethene

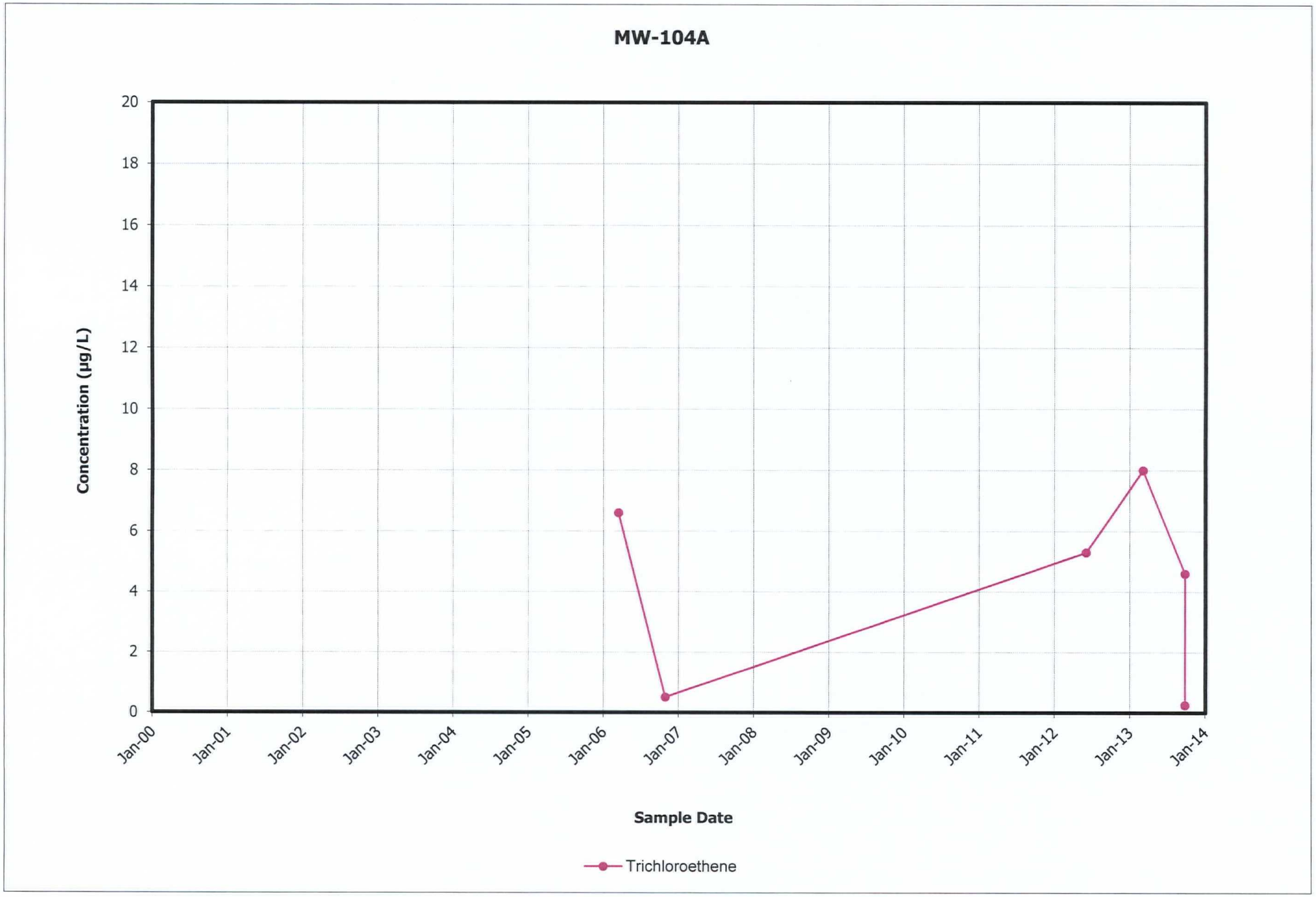

MW-ES-07
Concentration (µg/L)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Sample Date
Tetrachloroethene


PZ-720
Concentration (µg/L)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Sample Date
Tetrachloroethene

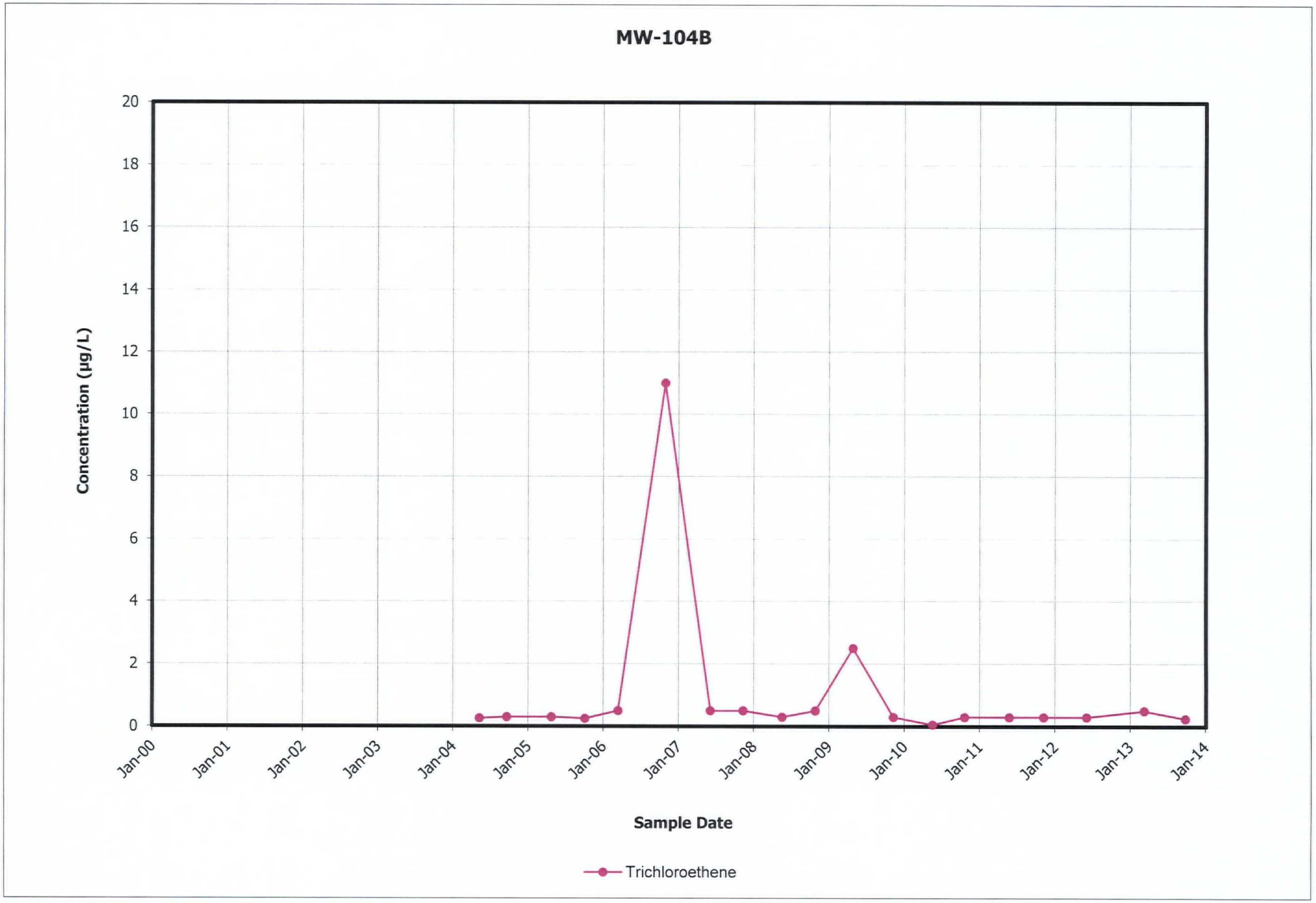

PZ-721
3
2.5
2
1.5
1
0.5
0
Concentration (µg/L)
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Sample Date
Tetrachloroethene

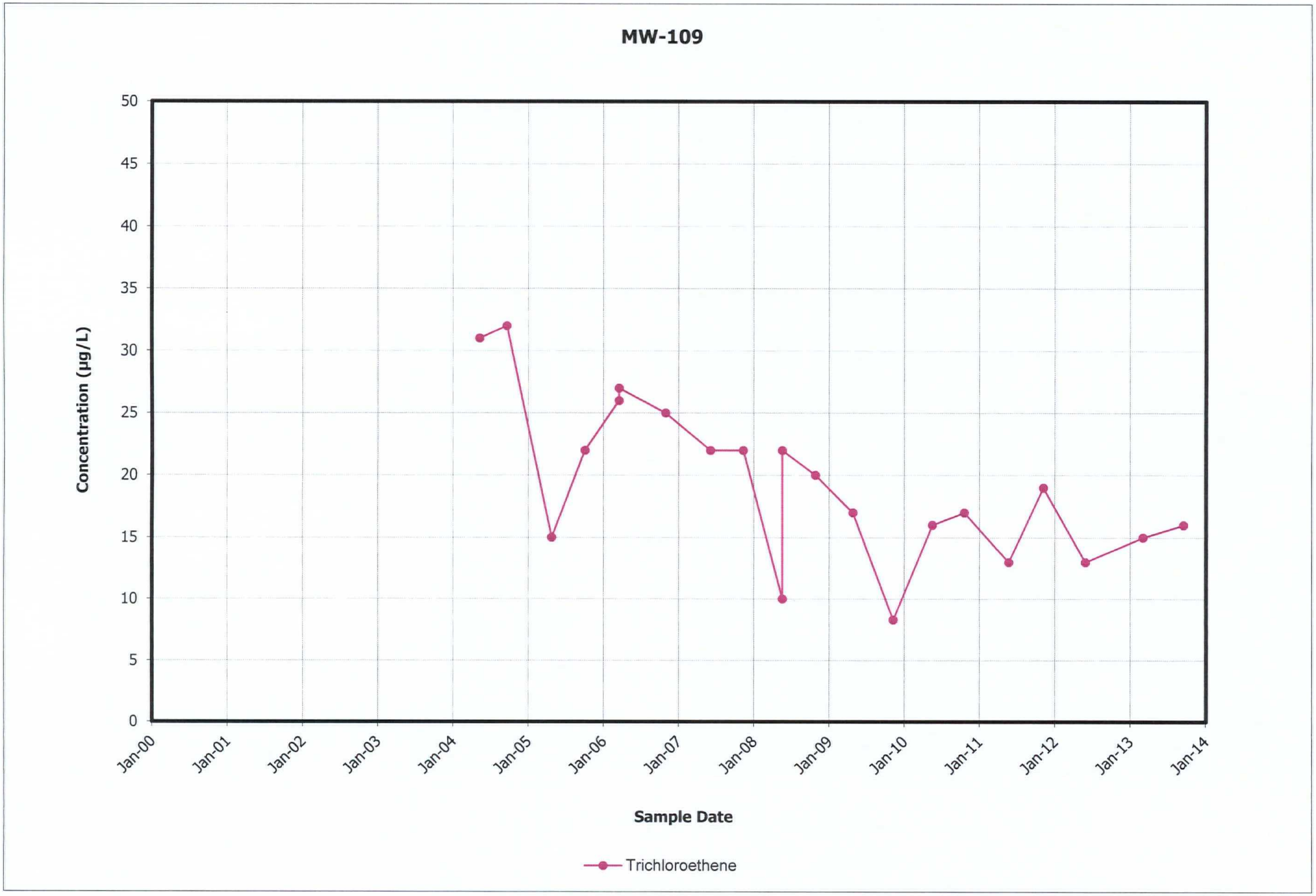

PZ-724
Concentration (µg/L)
0
0.5
1
1.5
2
2.5
3
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Sample Date
Tetrachloroethene

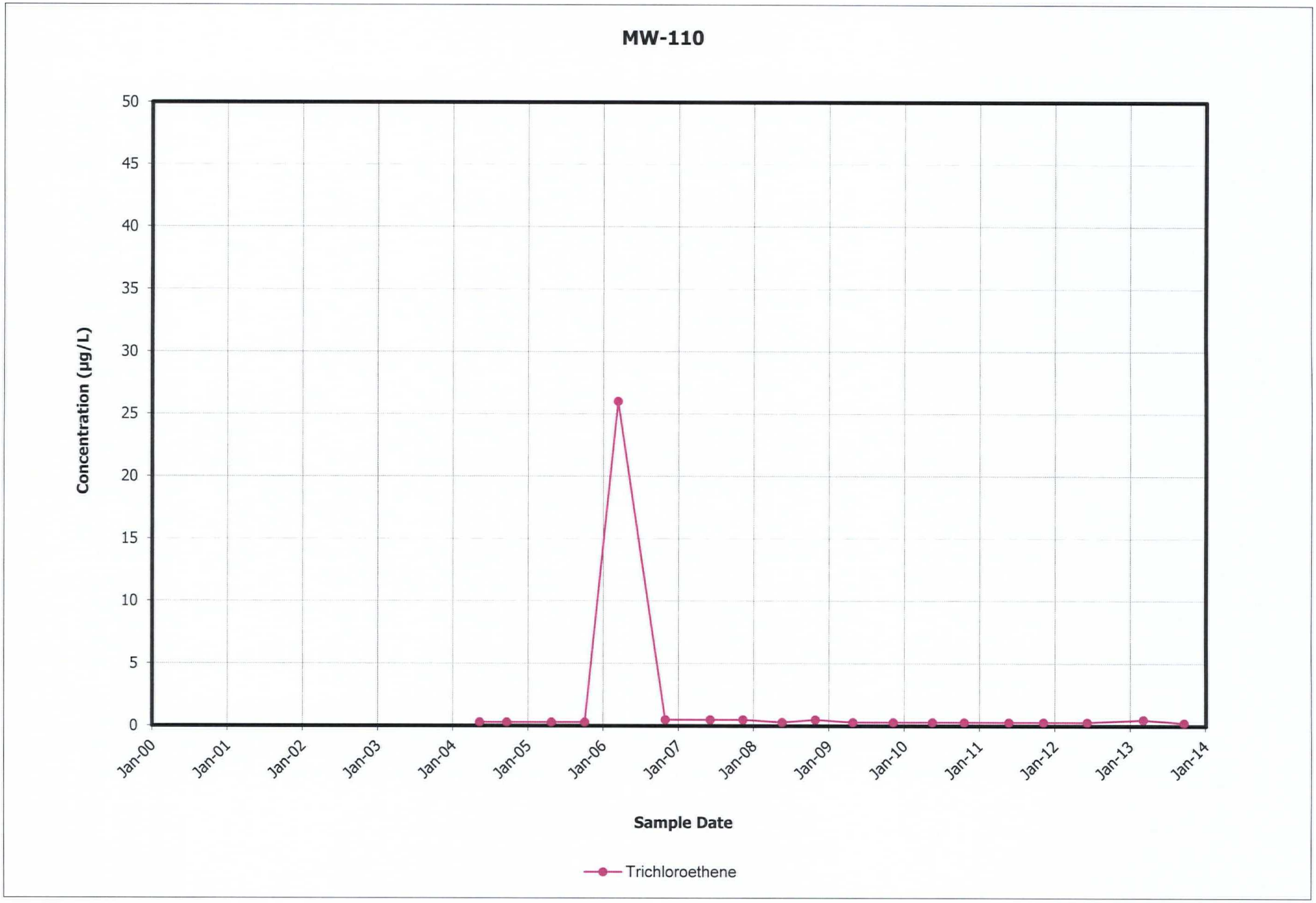

MW-101B
Concentration (µg/L)
20
18
16
14
12
10
8
6
4
2
0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Sample Date
Trichloroethene

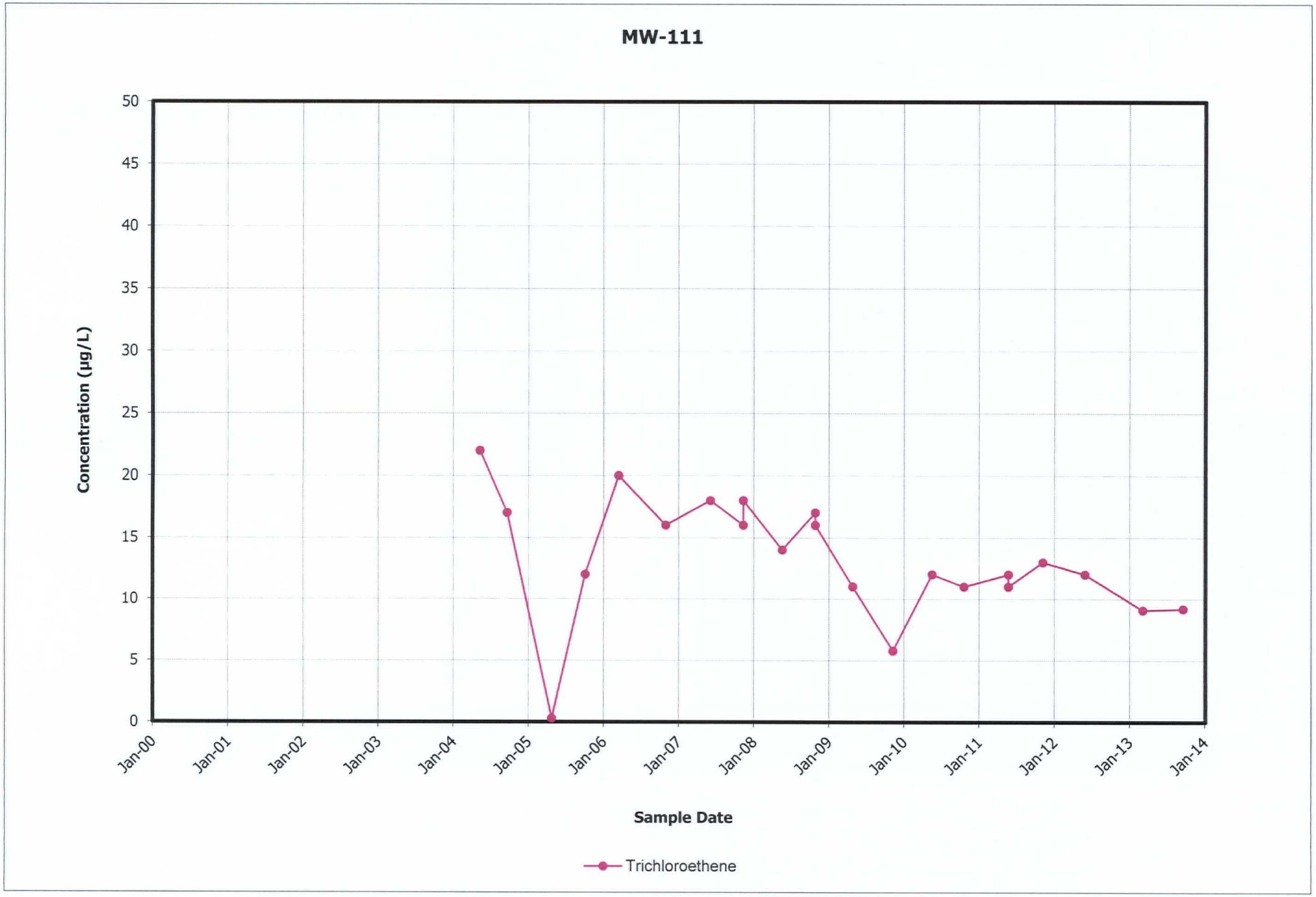


MW-104A
Concentration (µg/L)
0
2
4
6
8
10
12
14
16
18
20
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Sample Date
Trichloroethene

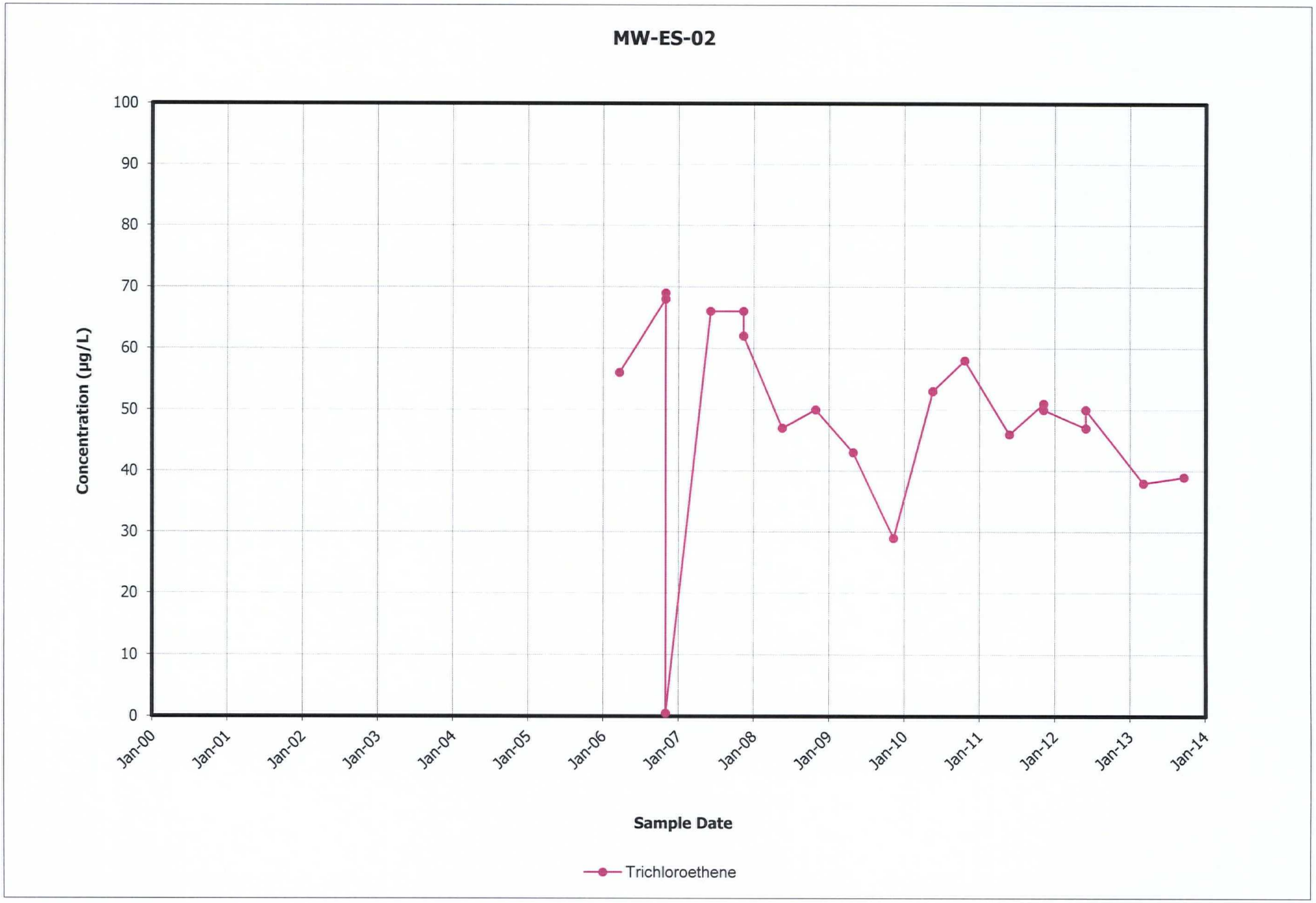

MW-104B
Concentration (µg/L)
20
18
16
14
12
10
8
6
4
2
0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Sample Date
Trichloroethene

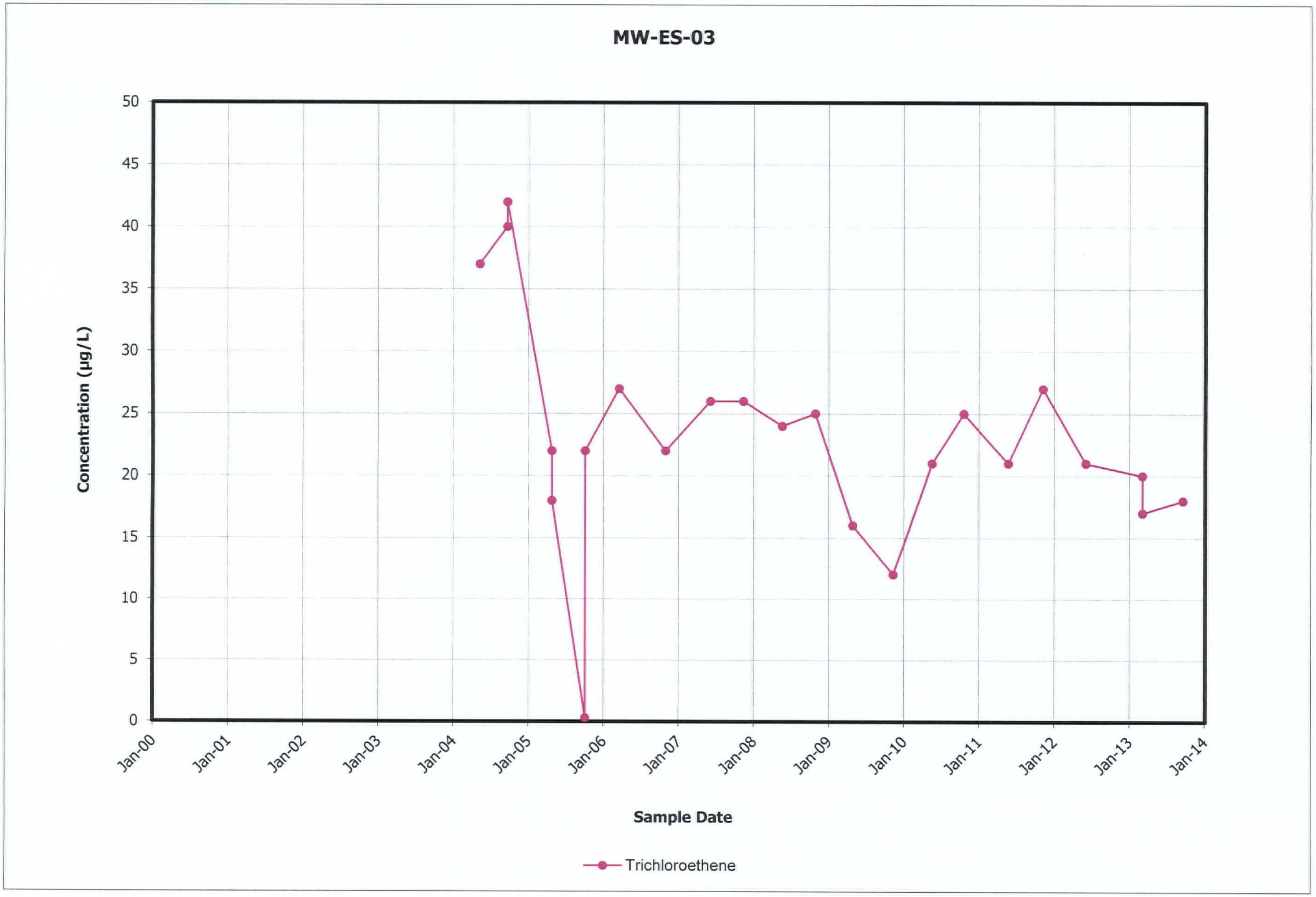

MW-109
Concentration (µg/L)
0
5
10
15
20
25
30
35
40
45
50
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Sample Date
Trichloroethene

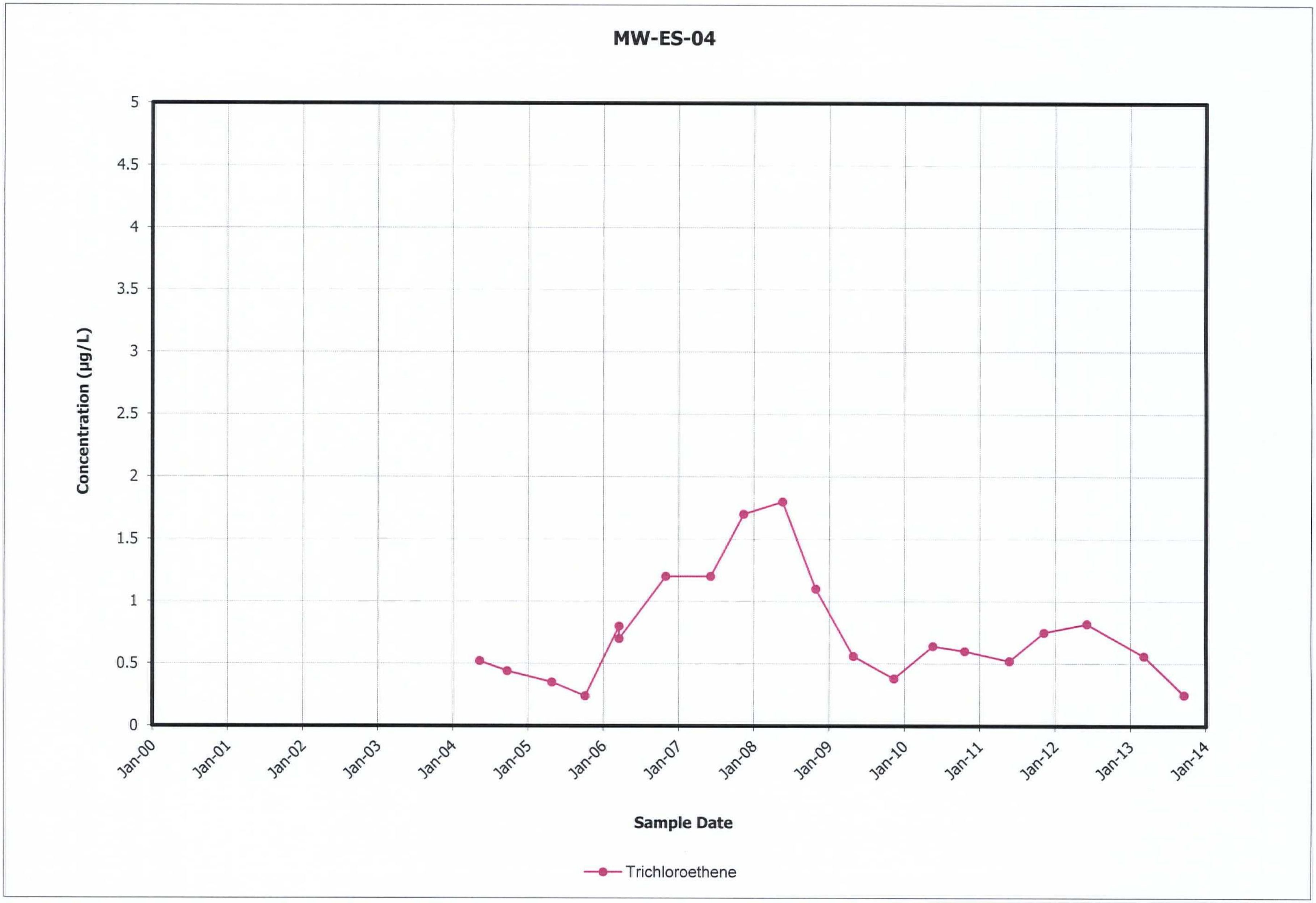

MW-110
Concentration (µg/L)
50
45
40
35
30
25
20
15
10
5
0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Sample Date
Trichloroethene

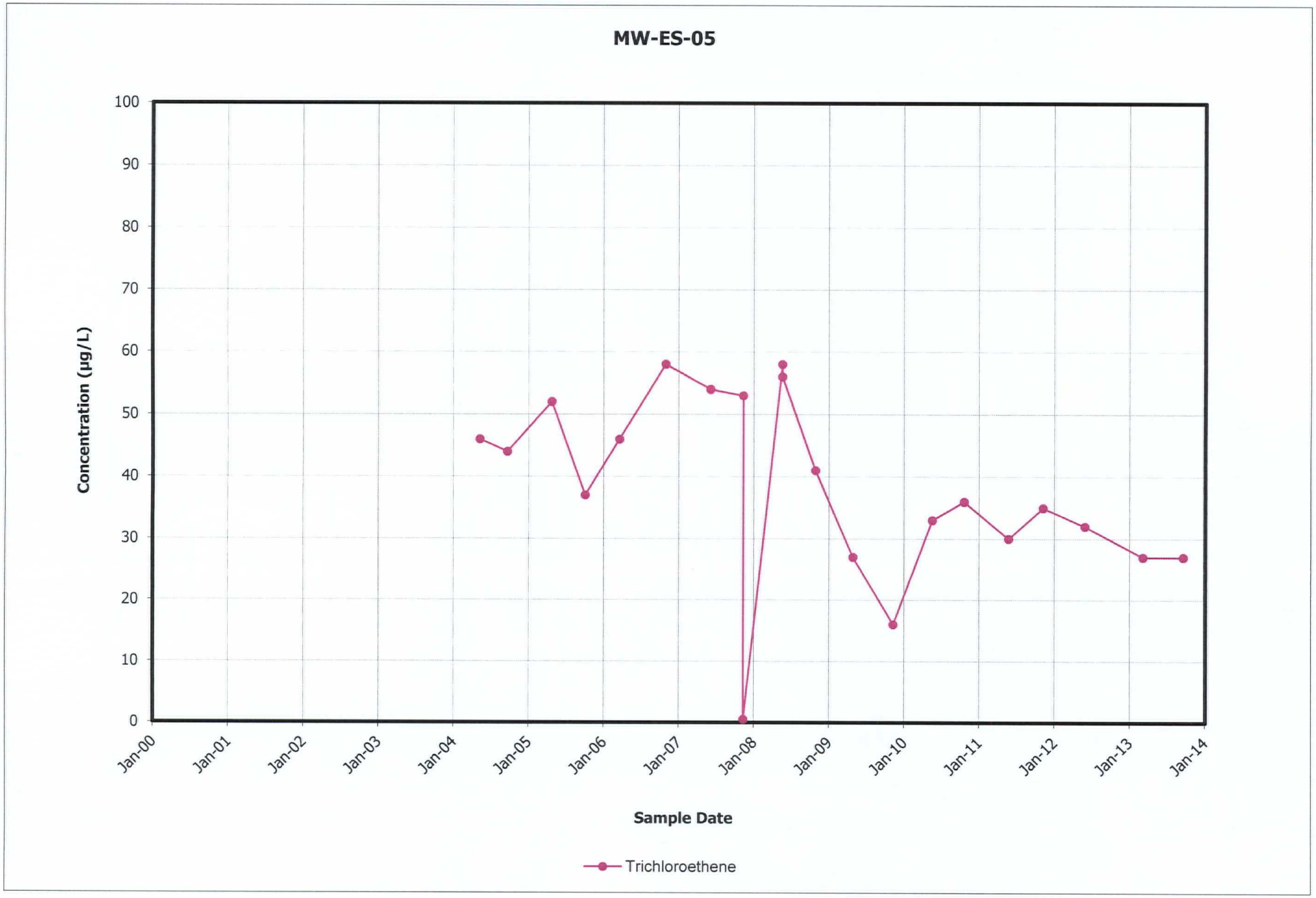


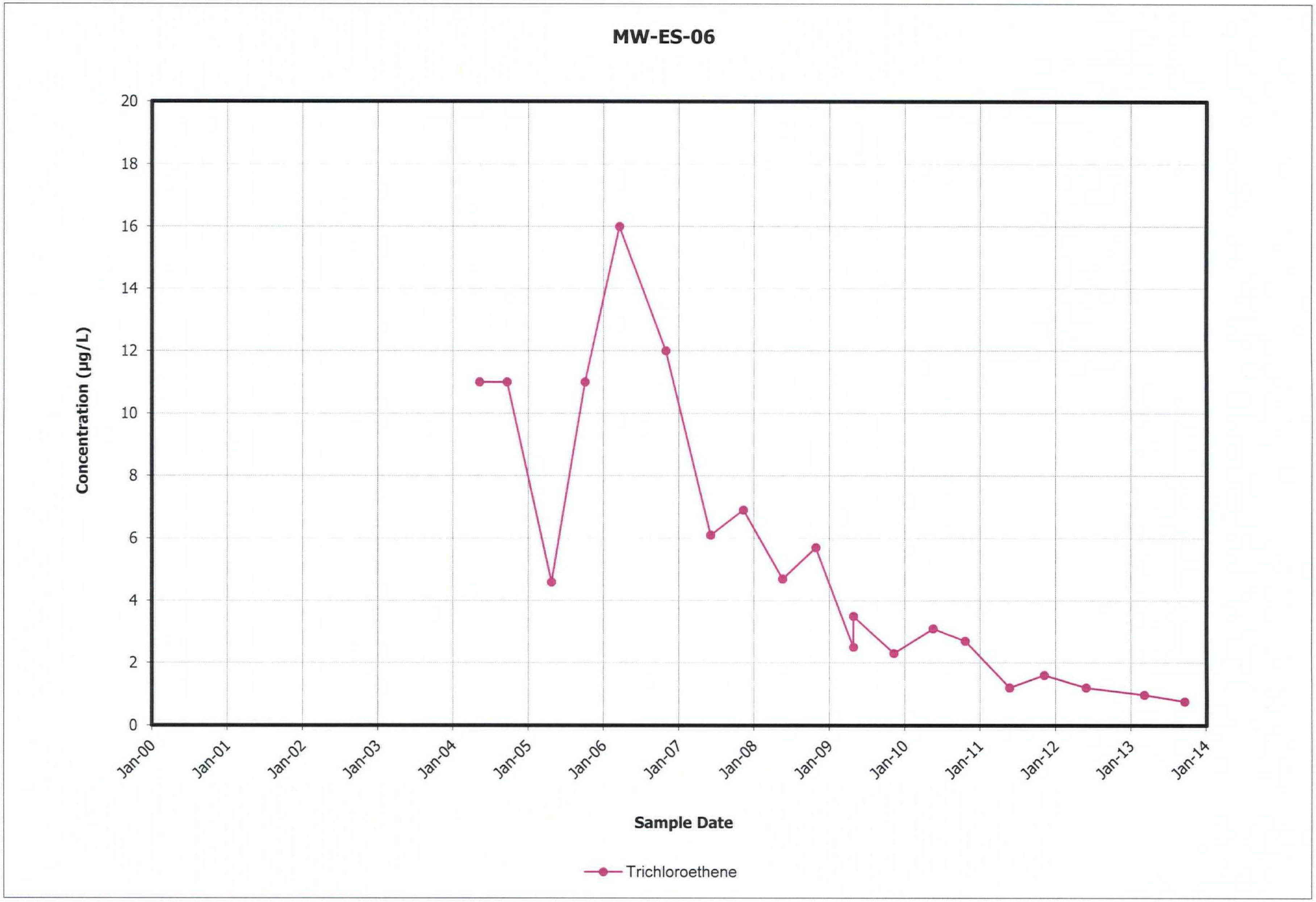
MW-111
Concentration (µg/L)
0
5
10
15
20
25
30
35
40
45
50
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Sample Date
Trichloroethene

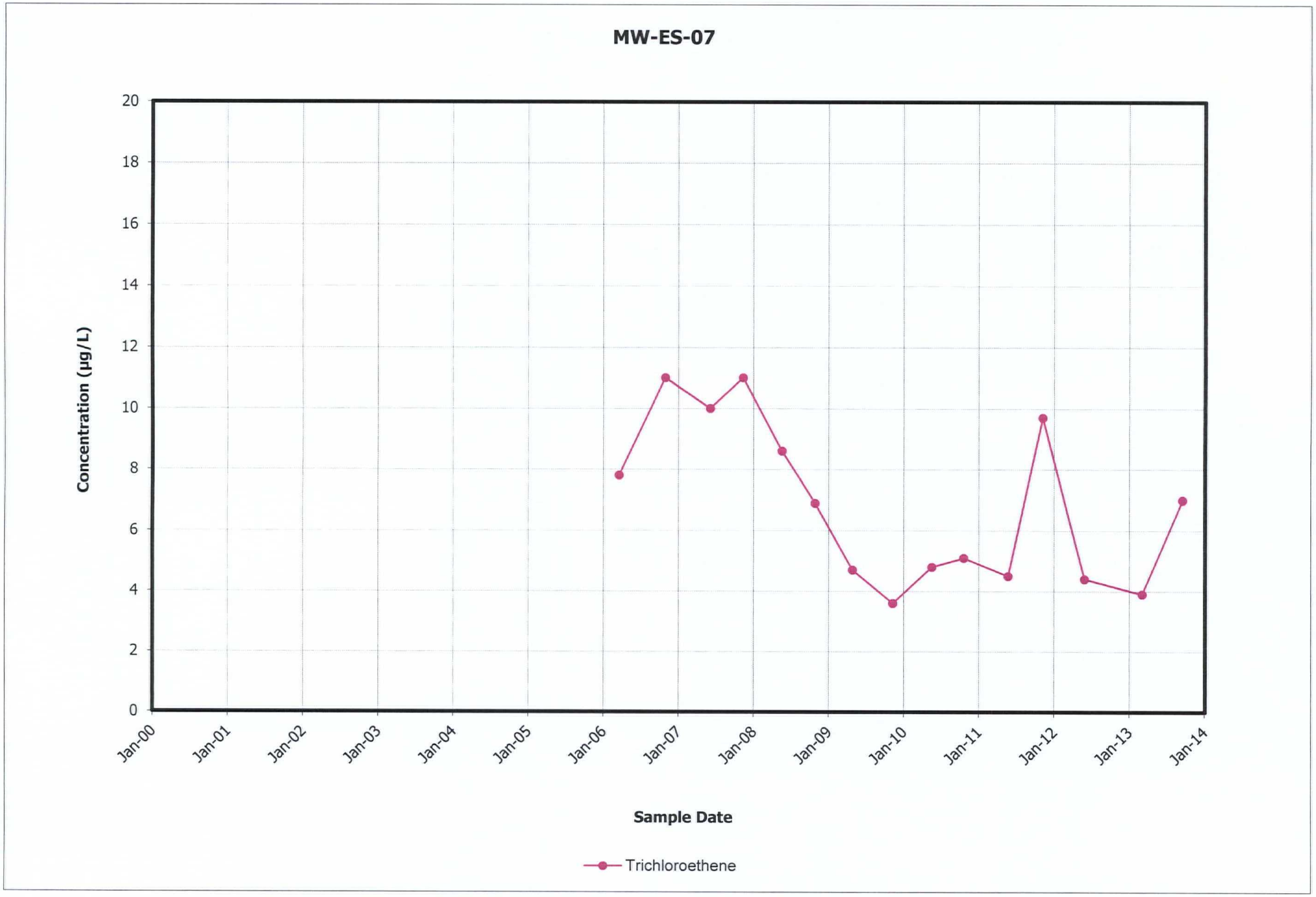

MW-ES-02
100
90
80
70
60
50
40
30
20
10
0
Concentration (µg/L)
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Sample Date
Trichloroethene

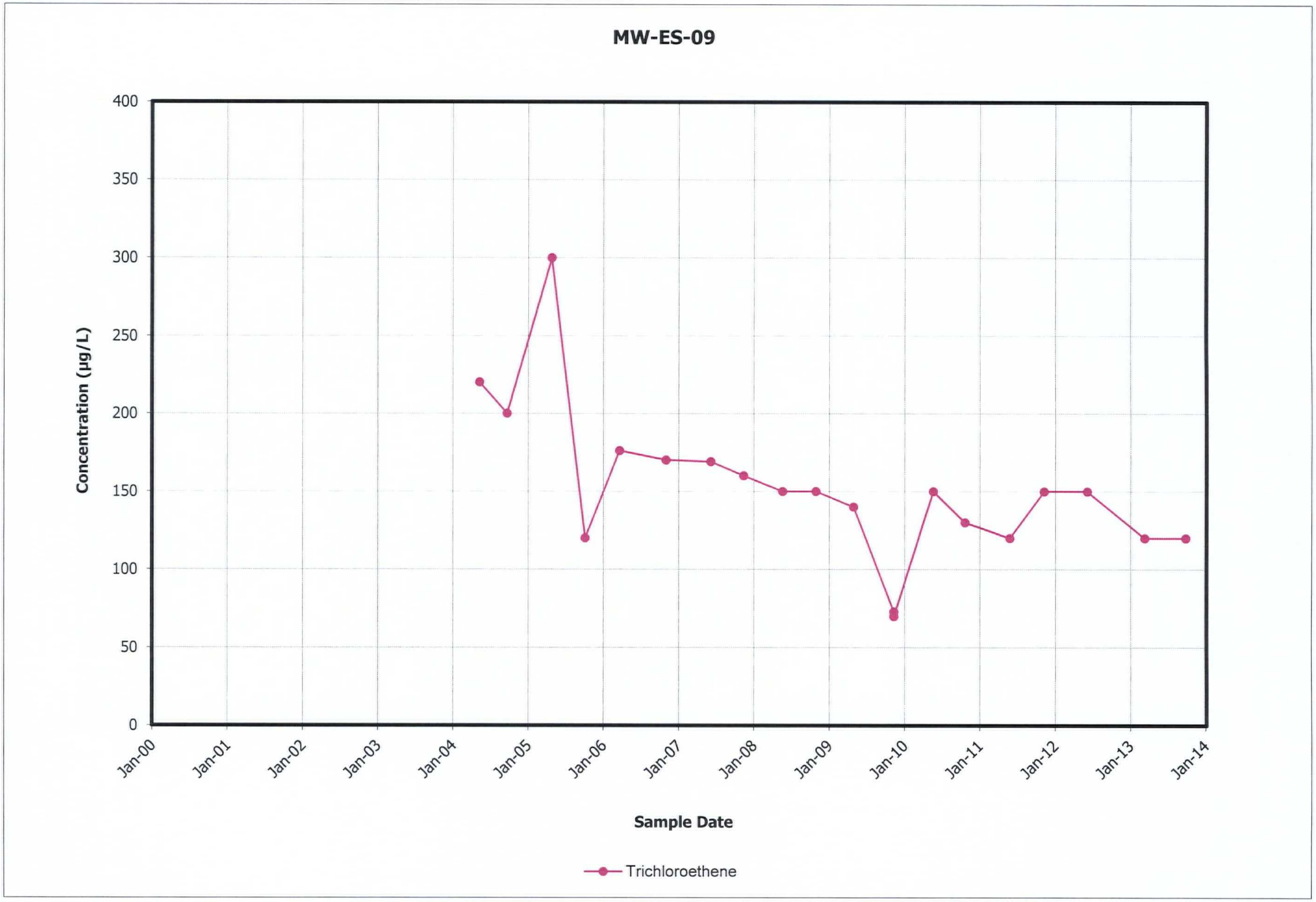

MW-ES-03
Concentration (µg/L)
50
45
40
35
30
25
20
15
10
5
0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Sample Date
Trichloroethene


MW-ES-04
Concentration (µg/L)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Sample Date
Trichloroethene

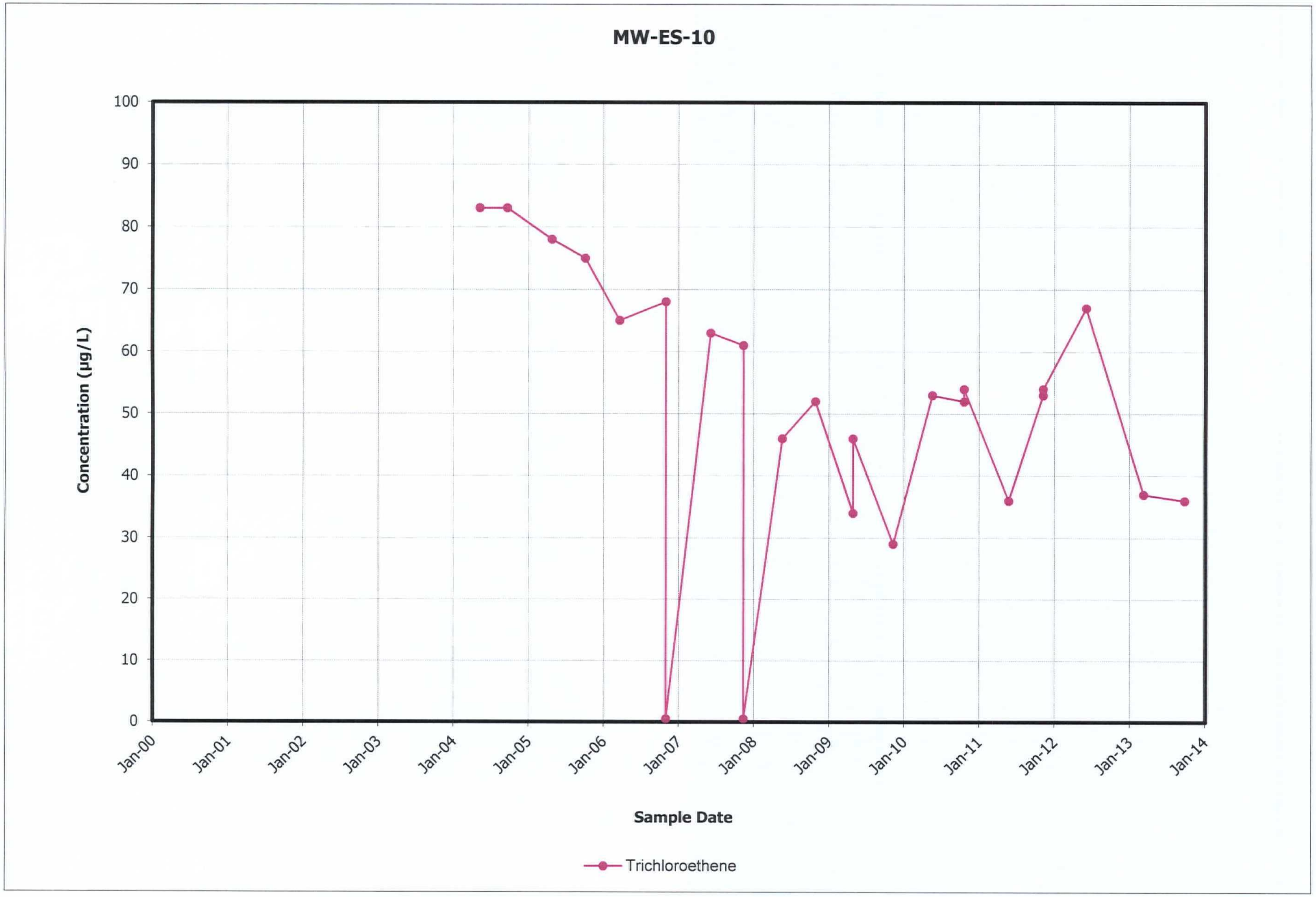

MW-ES-05
100
90
80
70
60
50
40
30
20
10
0
Concentration (µg/L)
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Sample Date
Trichloroethene

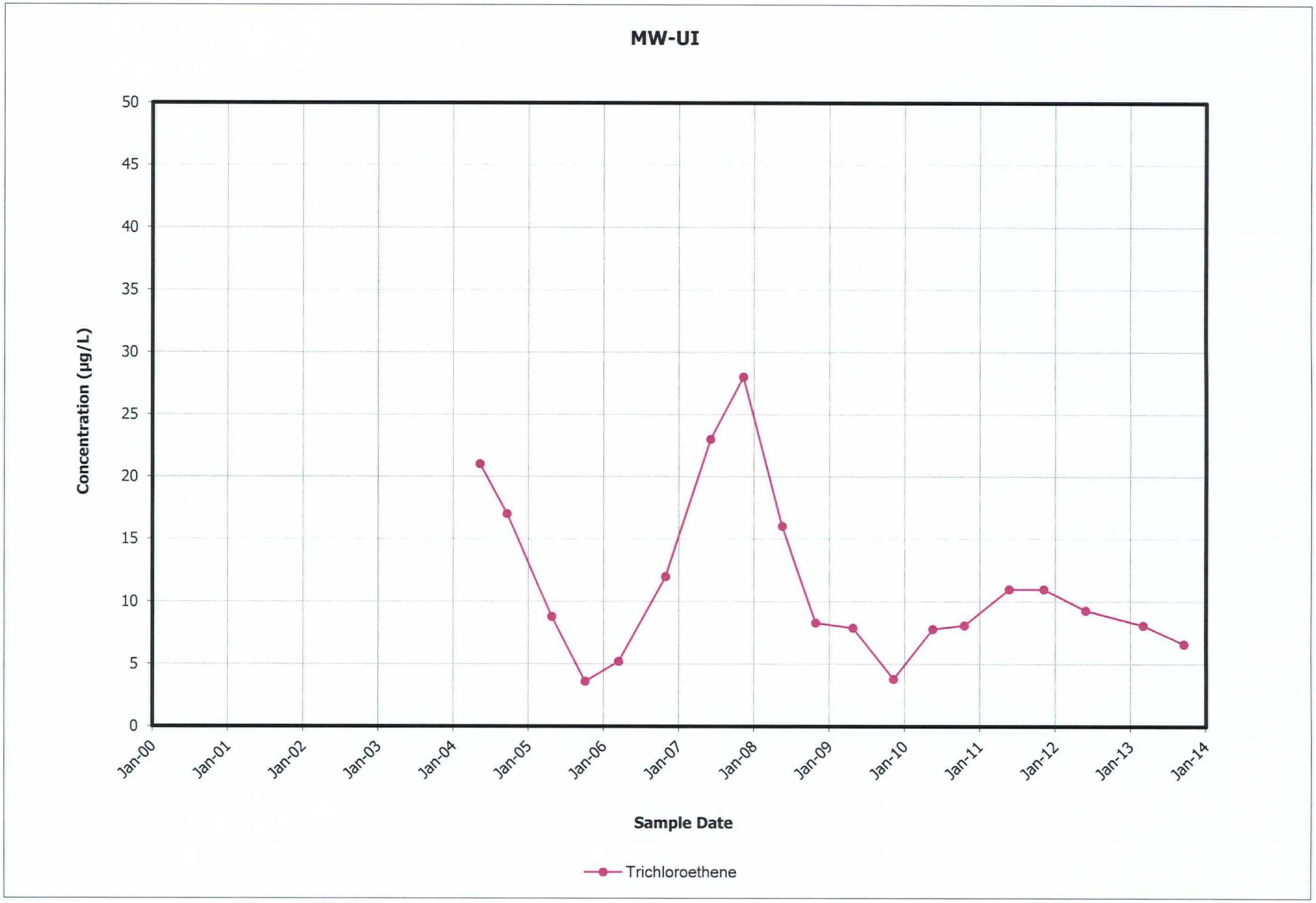

MW-ES-06
Concentration (µg/L)
0
2
4
6
8
10
12
14
16
18
20
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Sample Date
Trichloroethene


MW-ES-07
Concentration (µg/L)
0
2
4
6
8
10
12
14
16
18
20
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Sample Date
Trichloroethene



MW-ES-09
Concentration (µg/L)
400
350
300
250
200
150
100
50
0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Sample Date
Trichloroethene


MW-ES-10
100
90
80
70
60
50
40
30
20
10
0
Concentration (µg/L)
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Sample Date
Trichloroethene


MW-UI
Concentration (µg/L)
50
45
40
35
30
25
20
15
10
5
0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
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Jan-09
Jan-10
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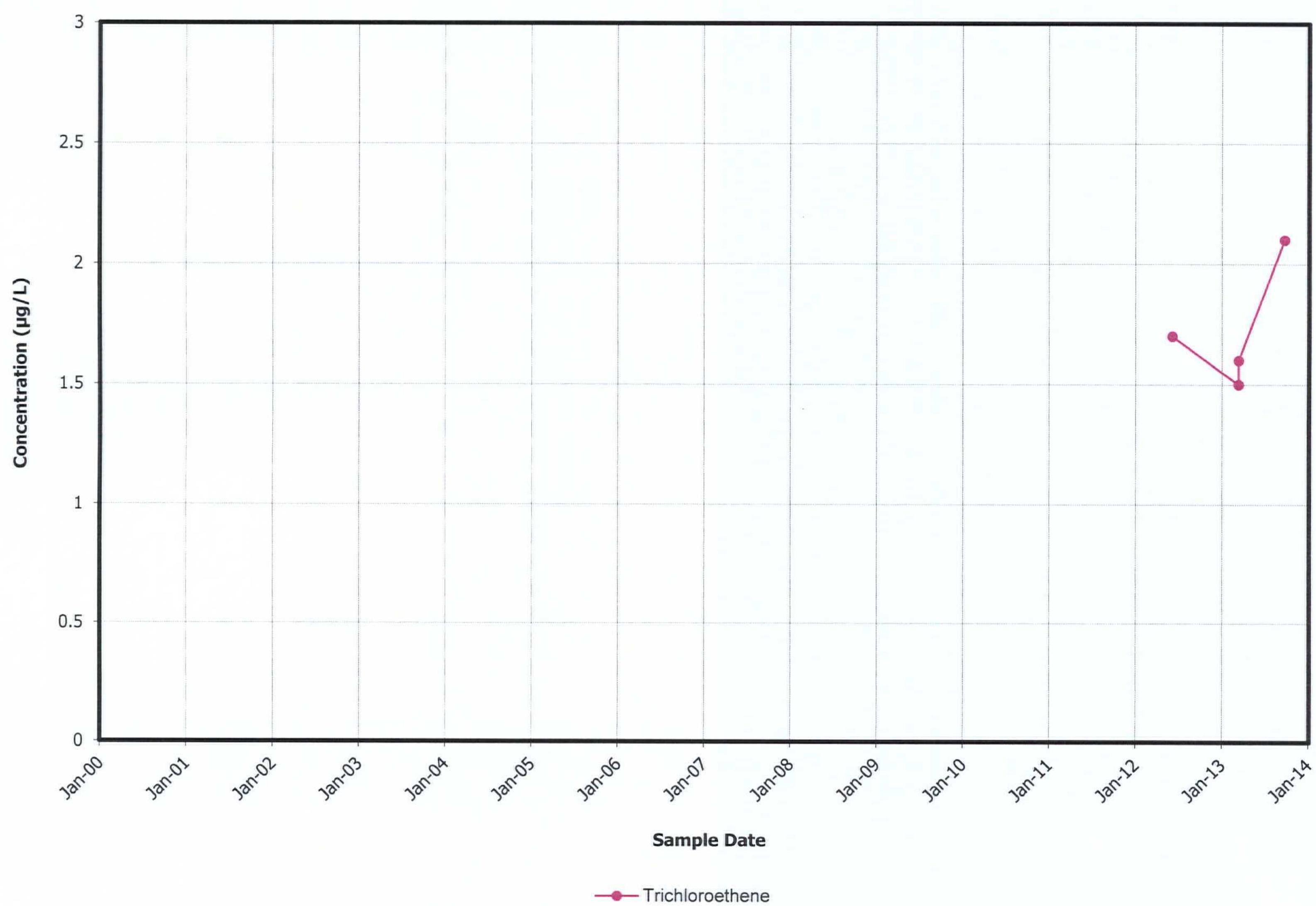
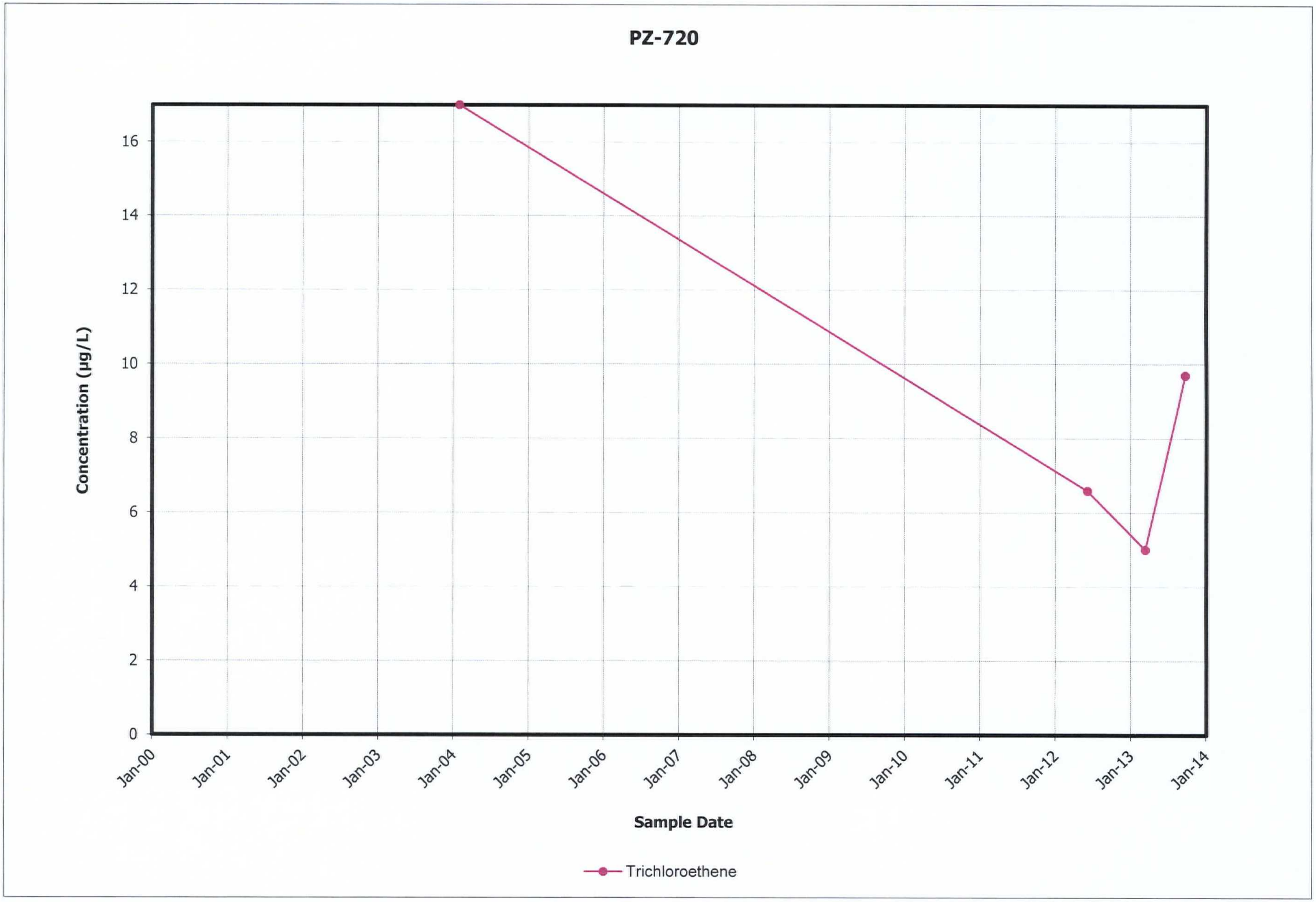
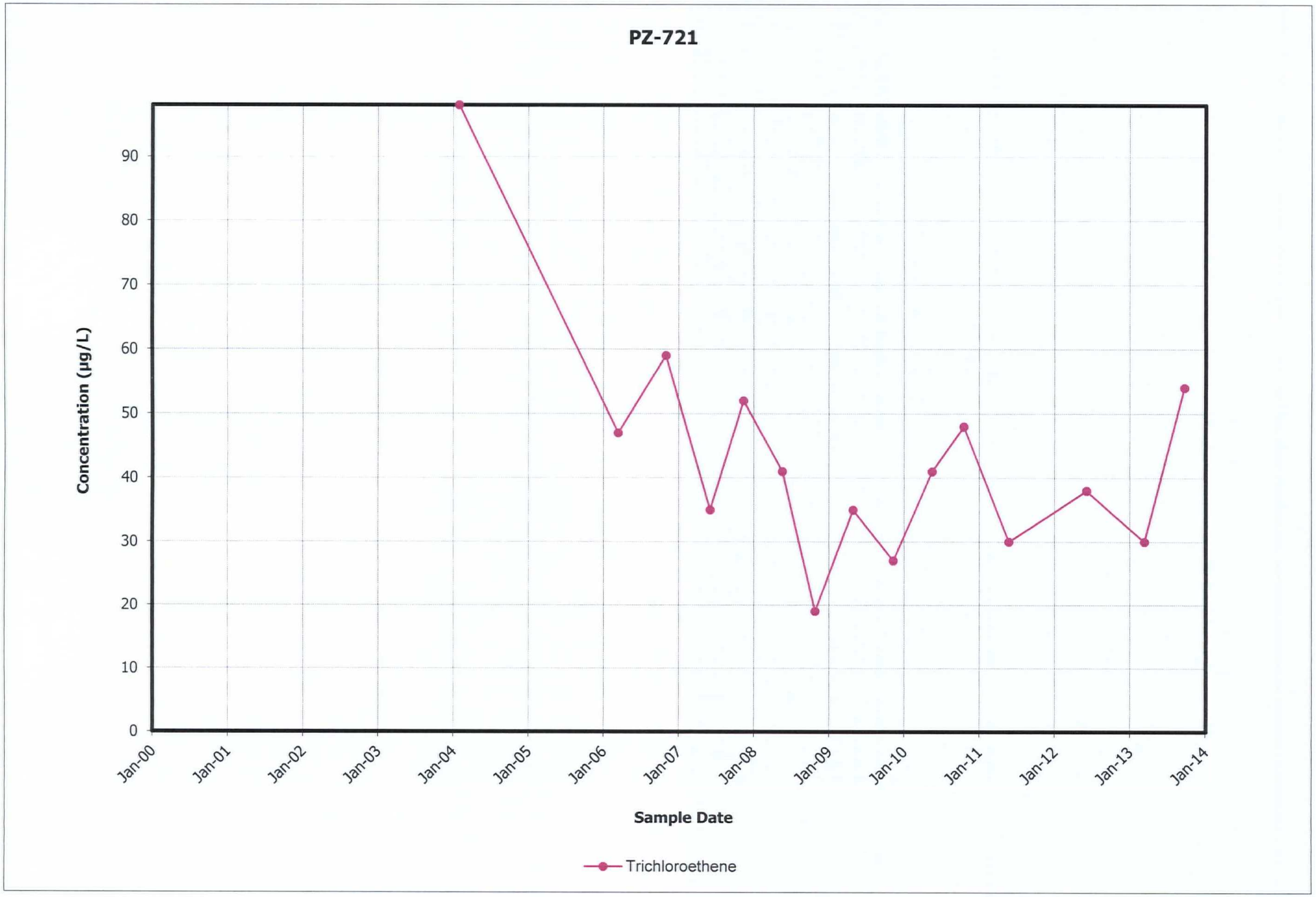
Jan-13
Jan-14
Sample Date
Trichloroethene

PZ-719

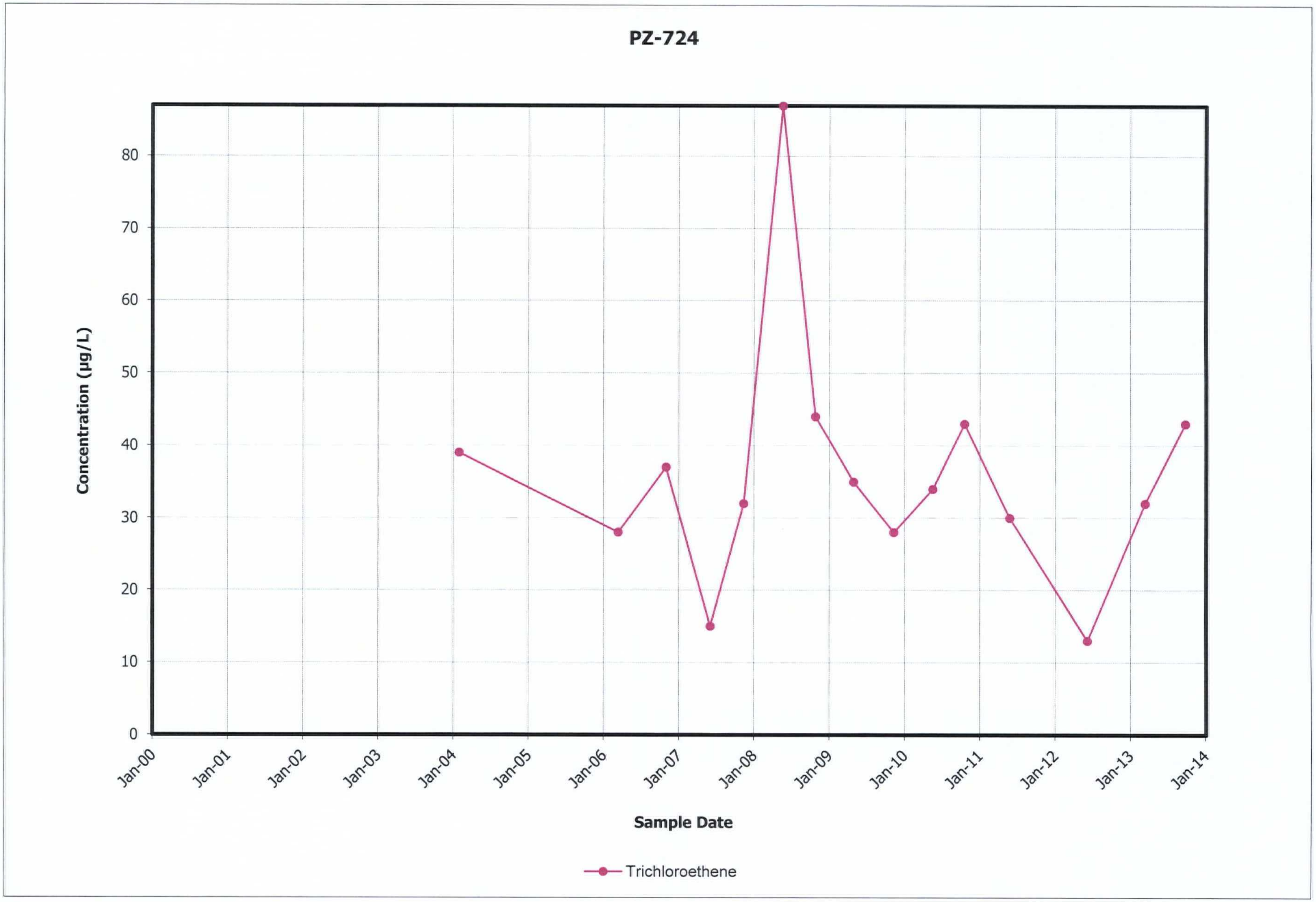


Concentration (µg/L)
3
2.5
2
1.5
1
0.5
0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Sample Date
Trichloroethene


PZ-720
Concentration (µg/L)
0
2
4
6
8
10
12
14
16
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Sample Date
Trichloroethene



PZ-721
Concentration (µg/L)
0
10
20
30
40
50
60
70
80
90
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Sample Date
Trichloroethene


PZ-724
Concentration (µg/L)
0
10
20
30
40
50
60
70
80
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Sample Date
Trichloroethene

APPENDIX F
Capture Zone Analysis

APPENDIX F
PRELIMINARY CAPTURE ZONE ANALYSIS

As part of evaluating the nature and extent of contamination at the Palermo Wellfield Superfund Site, a preliminary capture zone analysis was performed. This Wellfield preliminary capture zone analysis has been generated to aid in developing a regional potentiometric surface map within the upper aquifer capture zone with a three dimensional graphical interpretation of the capture zone, evaluating COC concentrations within the capture zone throughout the Site (including the Palermo residential neighborhood) and estimating the upper aquifer transmissivity and Wellfield pumping. Also as part of this preliminary capture zone analysis potential data gaps were identified along with proposed further investigations to consider during development of the RI.

The groundwater flow path and preliminary capture zone were generated using the EPA's W*h*AEM2000 model (Kraemer et al., 2007). The W*h*AEM2000 model is a public-domain program and was developed for two-dimensional (2D) groundwater capture-zone and wellhead protection area analyses.

The topographic image map for Thurston County (USDA NRCS) was used for the base map of the model.

Model Setup

The aquifer was assumed to be a confined, homogenous, and isotropic aquifer, with thickness of 40 feet, porosity of 0.25 (PGG, 1997, p. 2-16), and transmissivity between 30,000 and 35,000 gpd/ft (a hydraulic conductivity of 100 to 117 ft/day).

In order to delineate a capture zone for the Palermo Wellfield, a regional groundwater elevation was assumed by setting the head at southwest corner of Trosper Lake (Figure F-1) as 170 feet, with a gradient of 0.008 toward NE 65°. The gradient was simplified as uniformly distributed from the non-uniform case of PGG (1997, p. 78).

The locations of the pumping wells are shown in Figure F-1. The average pumping rates from 2006 to 2008 (Table F-1) were used as the constant pumping rate in the model.

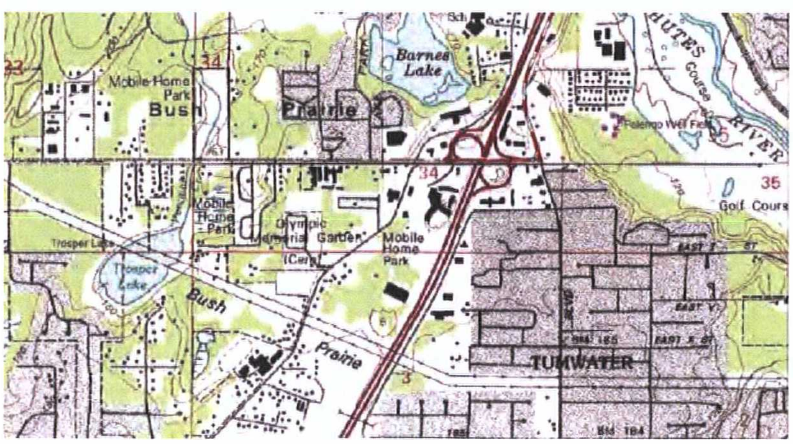


Figure F-1. Preliminary Capture-zone analysis, model domain.

TABLE F-1. AVERAGE PUMPING RATE FOR EACH WELL DURING 2006 THROUGH 2008.

Well Number	Well #2	Well #3	Well #4	Well #5	Well #6	Well #8
Pumping rate (gpm)	17.7	84.1	140.2	113.8	174.1	180.6

For viewing the flow lines of groundwater towards each well, 20 particles were set for each well in the model. The simulation period was set as 5 years and time-of-travel tics marked the location of the flow line for each year.

Two scenarios were modeled to test the sensitivity of aquifer transmissivity value on the extent of the capture zone. For Scenarios 1 and 2, transmissivity was assumed to be 30,000 gpd/ft and 35,000 gpd/ft, respectively.

Model Results and Discussion

Scenario 1

In Scenario 1, the transmissivity was assumed to be 30,000 gpd/ft (hydraulic conductivity of 100 ft/day). The groundwater surface elevation simulated for the pumping conditions was 85 feet for steady state conditions at the center of the Wellfield and ranged from 90 to 130 feet at the vicinity of the TCE plume. The maximum length of the simulated 5-year capture zone was 8,214 feet, and the width at the middle of the capture zone was 3,608 feet (Figure F-2). The western boundary of the capture zone reached the Trosper Lake by the middle of fifth year. The TCE plume is inside the 5-year capture zone.

Scenario 2

The assumed transmissivity in Scenario 2 was 35,000 gpd/ft (hydraulic conductivity 117 ft/day). The groundwater surface elevation simulated for the pumping conditions was 88 feet for steady state conditions at the center of the Wellfield, and ranged from 93 to 130 feet at the vicinity of the TCE plume. With the higher aquifer transmissivity, the simulated 5-year capture zone was slightly narrower and longer (Figure F-3) than that in Scenario 1, with the maximum length of 9,060 feet and the width of 3,230 feet at the middle. The western boundary of the capture zone reached the Trosper Lake by the end of year 4, and fully covered Trosper Lake by the end of year 5. Compared with Scenario 1, the northeastern boundary of the capture zone also shifted slightly towards the Wellfield, resulting from the assumed higher transmissivity of the aquifer. The TCE plume is still within the 5-year capture zone, but closer to the boundary than in Scenario 1.

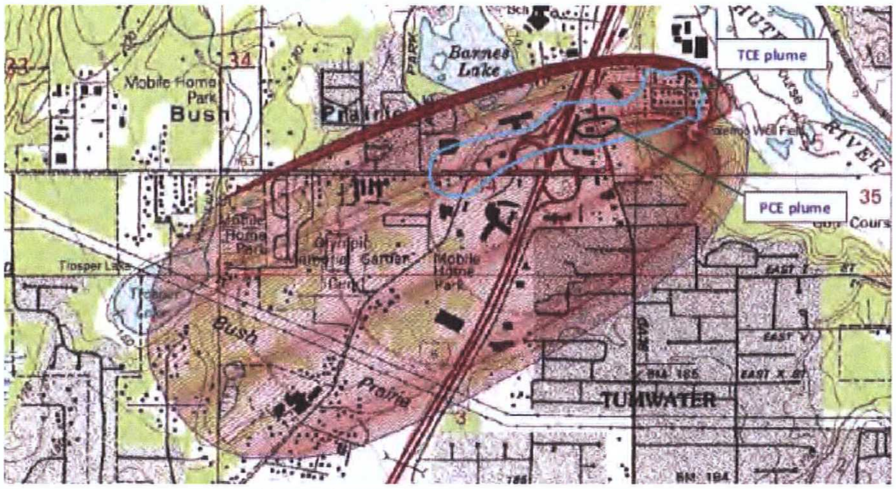


Figure F-2. The simulated 5-year capture zone, assuming a transmissivity of 30,000 gpd/ft. The circles on the path-lines show the yearly travel location of groundwater. The sketch of the TCE plume is based on measurements in Spring 2012.

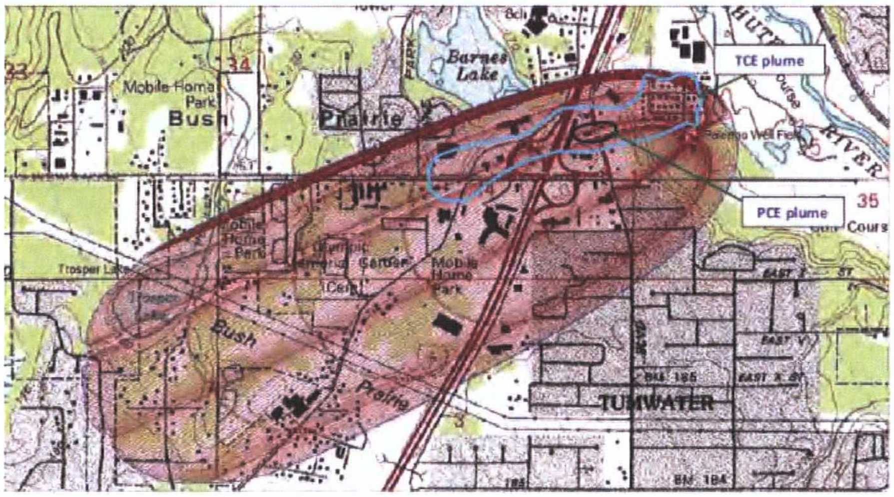


Figure F-3. The simulated 5-year capture zone, assuming a transmissivity of 35,000 gpd/ft. The circles on the pathlines show the yearly travel location of groundwater. The outline of the TCE plume is based on measurements in Spring 2012.

The W*h*AEM2000 is a 2D model. The capture zones shown are only the plan view. For partially penetrating wells, the capture zone may not extend to the bottom of the aquifer (U.S. EPA, 2008). The variations of aquifer thickness and bottom elevation cannot be simulated within the 2D model (Kraemer et al., 2007). To account for the vertical variations of the aquifer and different depths of wells, a three-dimensional (3D) model should be adopted when more detailed information is available. To accomplish a three-dimensional (3D) model the following information will be needed:

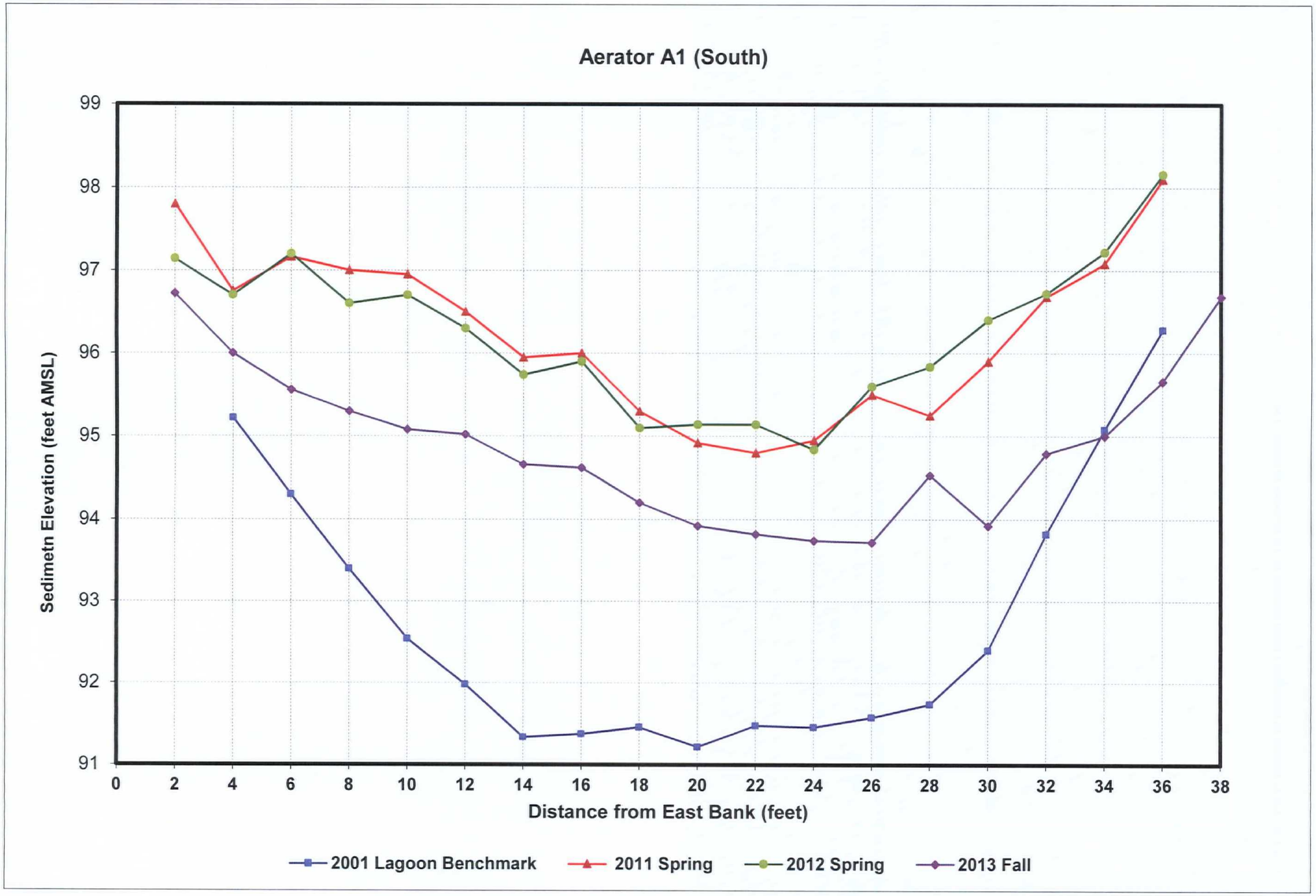
- Characteristics of aquifer and aquitard layers, including elevation and hydraulic properties of each layer, and their spatial variations obtained from reports, well logs, pumping tests, and tracer tests;

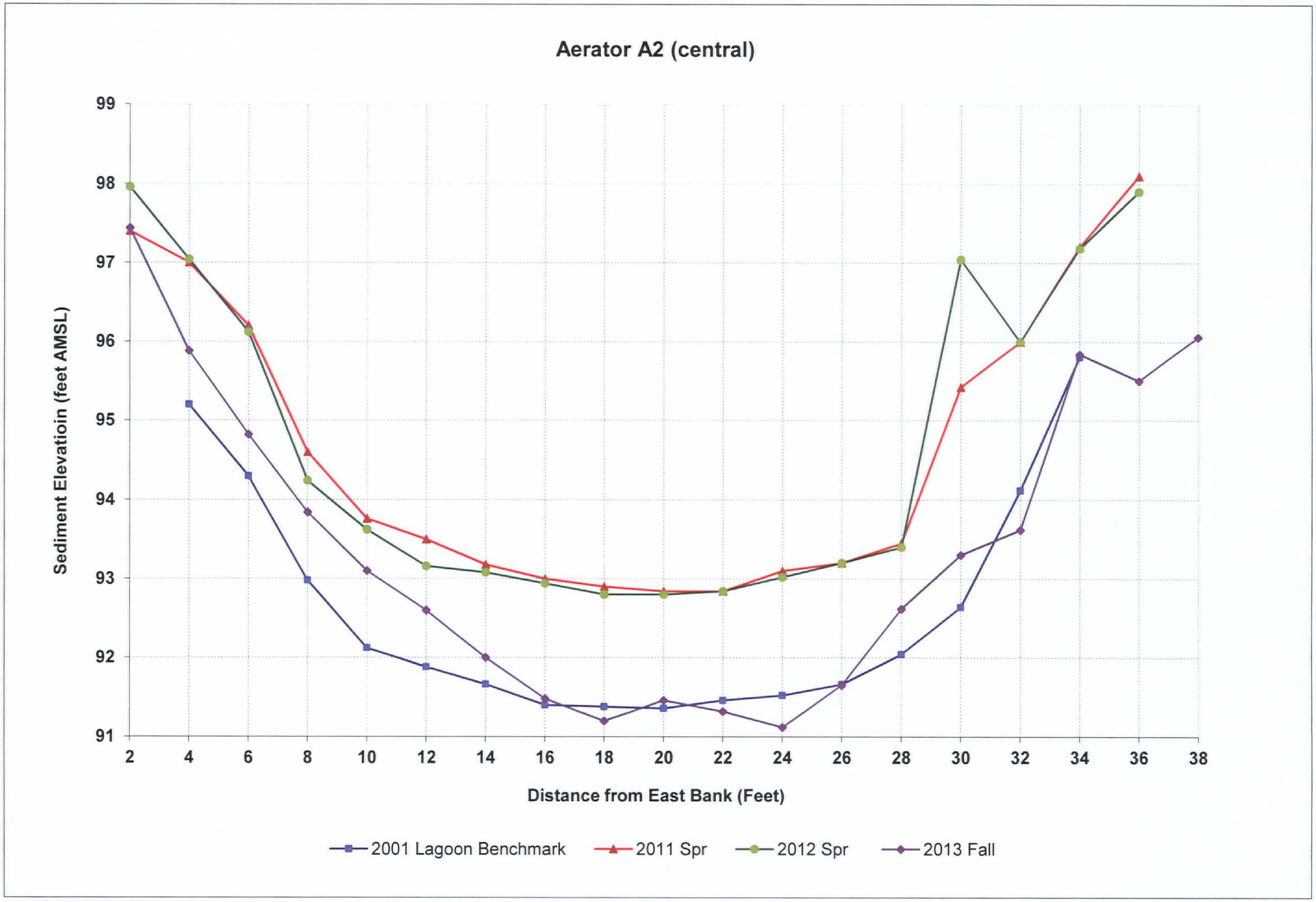
- hydraulic boundaries, including relationship between aquifer and lakes or rivers, constant-head, recharge, discharge, barrier, etc.;
- regional groundwater flow conditions; and
- plume properties and its temporal and spatial changes.

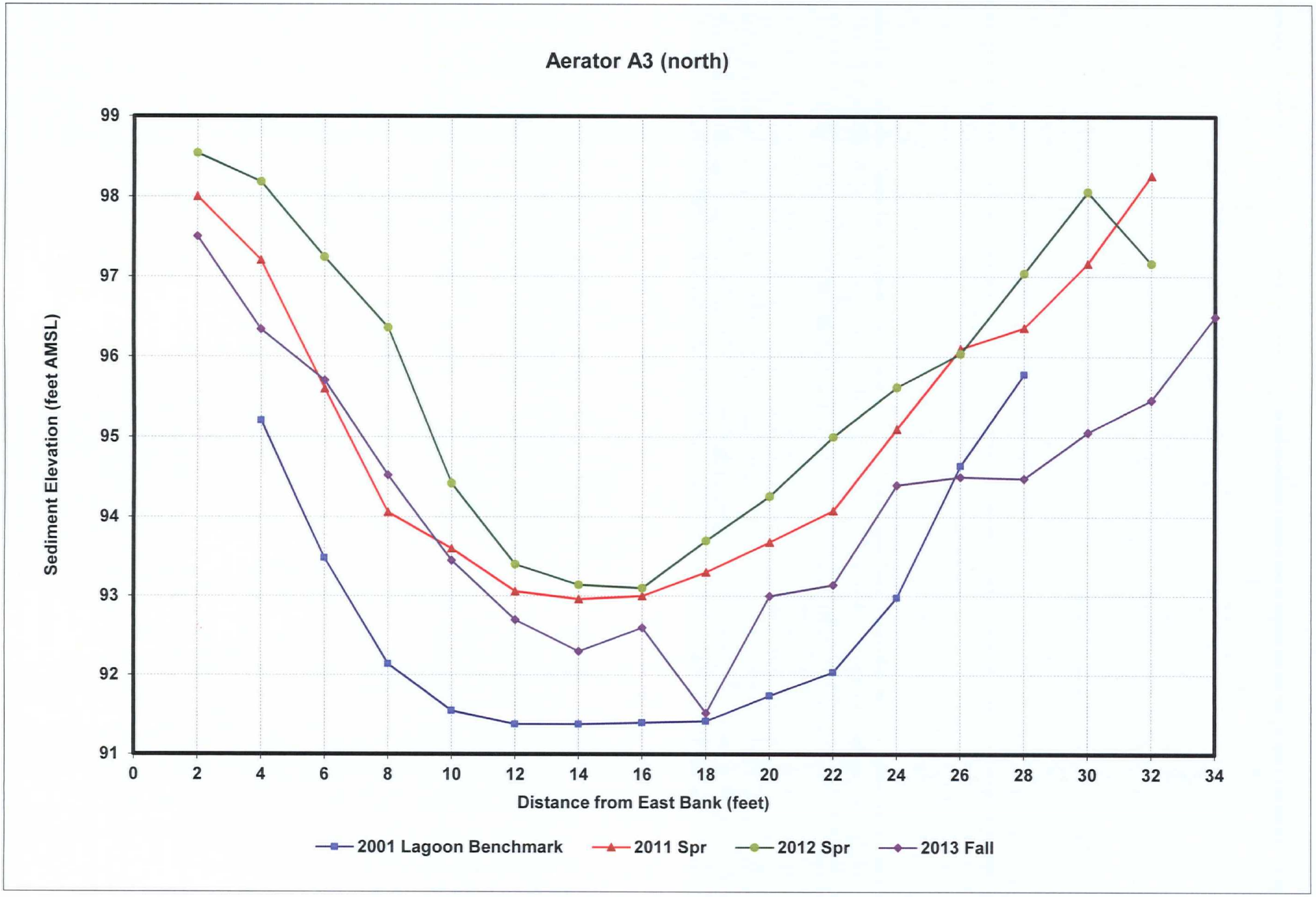
During the preparation of this preliminary capture zone, it has been determined more information is needed to accurately analyze and interpret the vertical gradient of groundwater and how COC concentrations move within the capture zone at the Site. It is, therefore, premature to provide a Site 3-D graphical interpretation of the capture zone and an evaluation of COC concentrations throughout the Site capture zone without completing additional investigation work.

We recommend that additional investigation activities be initiated during the preparation of the RI work plan and implementation of RI field activities to better understand the aquifer capture zone and it properties. Assuming that the 3-D model to be generated continues to be steady state, a phased approach for the modeling is proposed. A draft model would be created, calibrated, and tested using a set of sensitivity analyses. The sensitivity analyses would be run to identify how sensitive the simulation results are to changes made to the most uncertain hydrologic properties. If results are highly sensitive to a property with a lot of uncertainty, additional collection of field data would then be warranted. Once a calibrated 3-D groundwater flow model exists, it could be used for contaminant transport modeling.

APPENDIX G
Lagoon Transects


Aerator A1 (South)
Sedimetn Elevation (feet AMSL)
99
98
97
96
95
94
93
92
91
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
Distance from East Bank (feet)
2001 Lagoon Benchmark
2011 Spring
2012 Spring
2013 Fall


Aerator A2 (central)
Sediment Elevatioin (feet AMSL)
99
98
97
96
95
94
93
92
91
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
Distance from East Bank (Feet)
2001 Lagoon Benchmark
2011 Spr
2012 Spr
2013 Fall


Aerator A3 (north)
Sediment Elevation (feet AMSL)
99
98
97
96
95
94
93
92
91
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
Distance from East Bank (feet)
2001 Lagoon Benchmark
2011 Spr
2012 Spr
2013 Fall

APPENDIX H
Report Limitations and Guidelines for Use

APPENDIX H
REPORT LIMITATIONS AND GUIDELINES FOR USE

This appendix provides information to help you manage your risks with respect to the use of this report.

Report Use and Reliance

This report has been prepared for the Washington State Department of Transportation and can be distributed to Client's authorized agents and regulatory agencies as needed for the project.

GeoEngineers structures our services to meet the specific needs of our clients. Accordingly, no party other than the Washington State Department of Transportation may rely on the product of our services unless we agree to such reliance in advance and in writing. Within the limitations of scope, schedule and budget, our services have been executed in accordance with our Agreement with the Client for this project and generally accepted environmental practices in this area at the time this report was prepared.

This report should not be applied for any purpose or project except the one originally contemplated. If important changes are made to the project or property after the date of this report, we recommend that GeoEngineers be given the opportunity to review our interpretations and recommendations, and then we can provide written modifications or confirmation, as appropriate.

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